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Impulsivity in forensic populations

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Doctorate in Clinical Psychology

The University of Edinburgh

August 2018

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OVERVIEW TO THESIS PORTFOLIO

This thesis was completed in part fulfilment of the Doctorate in Clinical Psychology. It is divided into two chapters: chapter one is a systematic review of the literature investigating impulsivity in forensic populations; and chapter two is an empirical study investigating the predictive utility of selected impulsivity measures to identify violence and antisocial behaviour in forensic mental health units.

PORTFOLIO THESIS ABSTRACT

Purpose: The systematic review summarised the research investigating potential risk factors for impulsive behaviours in forensic populations. The empirical study examined the predictive utility of clinician rated, self-report and behavioural measures of impulsivity in detecting violence and antisocial behaviour in forensic mental health inpatient settings.

Method: The review is comprised of 9 studies identified through electronic database searches using a structured search strategy and predetermined inclusion criteria. The empirical study employed a cross-sectional design using retrospective and prospective statistical analysis. Forty-three participants were recruited from secure forensic mental health inpatient settings across Scotland and data collected from clinician rated, self-report and behavioural measures of impulsivity.

Results: The review found original evidence to suggest that traumatic brain injury, substance and alcohol misuse, trauma and sleep as possible predictors of impulsive behaviour in forensic populations. The empirical study found a relatively consistent relationship between impulsive behaviour and violent or antisocial behaviour in a sample of forensic mental health inpatients.

Conclusions: The systematic review identified a limited number of risk factors thought to influence impulsive behaviour in forensic populations. The review highlights the need for future research with improved methodological design to further explore contributory factors for increased levels of impulsivity. Findings from the empirical study reveal clinician rating of impulsive behaviour to be the most sensitive in predicting future incidents of violent and antisocial behaviour, which may be supplemented by the addition of a self-report measure.

LAY SUMMARY

This thesis is in two parts and is focused on impulsivity in forensic populations.

The first part is a systematic review, which considered published research examining possible causes for impulsive behaviour in forensic populations. This review identified nine research papers which revealed head injury, substance or alcohol misuse, traumatic experiences and sleep problems as potential risk factors for higher levels of impulsiveness. More research is needed to work out how strong the relationship is between the risk factors identified in the study and impulsive behaviour amongst forensic populations.

The second part is an original research study. It focused on examining selected assessment tools of impulsive behaviour and their ability to predict violent and antisocial behaviour. The people who took part in the study were patients currently residing in secure forensic mental health inpatient settings within Scotland. The findings of the study showed that clinician rating and self-report measures of impulsivity to be the most predictive of future violent and antisocial behaviour. Further research is needed with more people taking part and longer follow-up periods to confirm these findings.

TABLE OF CONTENTS

DECLARATION OF OWN WORK	2
ACKNOWLEDGEMENTS	3
OVERVIEW TO THESIS PORTFOLIO	4
PORTFOLIO THESIS ABSTRACT	5
LAY SUMMARY	6
TABLE OF CONTENTS	7
LIST OF TABLES	10
LIST OF FIGURES	10
CHAPTER 1: SYSTEMATIC REVIEW	
ABSTRACT	12
1. INTRODUCTION	13
1.1 Objectives of the current review	15
2. METHOD	16
2.1 Review protocol	16
2.2 Search strategy	16
2.3 Study selection criteria	16
2.4 Study selection	17
2.5 Quality assessment	17
2.6 Data extraction	18
3. RESULTS	20
3.1 Study characteristics	20
3.2 Methodological review	20
3.3 Measures of impulsivity	21
3.4 Potential predictors of impulsivity	24
4. DISCUSSION	30
4.1 Summary of findings	30

4.2 Strengths and limitations of the current review.....	32
4.3 Implications for future research and clinical practice.....	33
4.4 Conclusions	34
REFERENCES.....	35
CHAPTER 2: EMPIRICAL PROJECT	
ABSTRACT	45
1. INTRODUCTION.....	46
1.1 Violent and antisocial behaviour.....	46
1.2 Impulsivity and violent or antisocial behaviour in forensic populations...	46
1.3 Models of impulsivity	47
1.4 Assessment of impulsivity	47
1.5 Aims of the current study.....	48
2. METHOD.....	49
2.1 Design	49
2.2 Participants.....	49
2.3 Measures.....	50
2.4 Procedure	53
2.5 Analytical plan and statistical tests	53
3. RESULTS.....	55
3.1 Sample characteristics	55
3.2 Mean scores on impulsivity measures.....	56
3.3 Correlations between impulsivity measures and background characteristics.....	57
3.4 Retrospective analysis.....	58
3.5 Prospective analysis.....	62
4. DISCUSSION	66
4.1 Strengths and limitations of the current study	69

4.2 Conclusions	70
REFERENCES	72
THESIS PORTFOLIO REFERENCES	79
LIST OF APPENDICES	91
Appendix A: Journal of Aggression and Violent Behaviour author guidelines.....	92
Appendix B: Quality assessment tool.....	110
Appendix C: Quality assessment scores for each included paper	111
Appendix D: Journal of Criminal Justice author guidelines	112
Appendix E: Ethical approval documentation.....	129
Appendix F: Participant information sheet.....	142
Appendix G: Participant consent form.....	145

LIST OF TABLES

Table 1.1: General characteristics of the 9 studies included for full review	22-23
Table 1.2: Potential predictors of impulsivity - cross sectional studies	27-28
Table 1.3: Potential predictors of impulsivity - longitudinal studies	29
Table 2.1: Sample characteristics	56
Table 2.2: Total mean scores for measures of impulsivity	57
Table 2.3: Correlation coefficient between self-report or behavioural impulsivity measures and background characteristics.....	58
Table 2.4: Univariate regression analysis for impulsivity to predict antisocial and violent behaviour (total retrospective SDAS scores).....	59
Table 2.5: Hierarchical multiple regression analysis for impulsivity to predict antisocial and violent behaviour (total retrospective SDAS scores).....	60
Table 2.6: ROC curve analysis for measures of impulsivity detecting retrospective violent behaviour in secure inpatient settings	61
Table 2.7: ROC curve analysis for measures of impulsivity detecting retrospective verbal and physical violence in secure inpatient settings.....	62
Table 2.8: Univariate regression analysis for impulsivity to predict antisocial and violent behaviour (total prospective SDAS scores)	63
Table 2.9: Hierarchical multiple regression analysis for impulsivity to predict antisocial and violent behaviour (total prospective SDAS scores)	64
Table 2.10: ROC curve analysis for measures of impulsivity detecting prospective incidents of violent behaviour in secure inpatient settings	65
Table 2.11: ROC curve analysis for measures of impulsivity detecting prospective incidents of verbal aggression and violent behaviour in secure inpatient settings...	65

LIST OF FIGURES

Figure 1: PRISMA flow diagram of the review process	19
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Examining the possible causes of impulsivity in forensic populations: a systematic review

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Abstract

Background: Elevated levels of impulsivity are considered a significant risk factor for violent behaviour within forensic populations. A comprehensive review of factors associated with impulsivity in forensic settings is lacking. The current review aims to collate and critically evaluate existing research examining possible causes for increased levels of impulsivity in forensic populations.

Method: A systematic review of the current literature was conducted. Multiple electronic databases including PsycINFO, MEDLINE, EMBASE, and ProQuest Criminal Justice and Social Sciences were searched. Methodological quality assessment of eligible articles was completed prior to a narrative synthesis of findings.

Results: Nine studies were included for review. Overall, the research was rated to be of “adequate” to “good” quality. Studies were limited in their use of prospective, longitudinal methodological design to assess the relationship between study variables and impulsive behaviour. Risk factors for elevated levels of impulsivity which emerged included traumatic brain injury, substance or alcohol misuse, traumatic experiences and sleep problems.

Conclusions: The evidence-base exploring possible causes for elevated levels of impulsivity in forensic populations is not well established and further research is required. However, the reviewed studies offer valuable information to clinicians when screening for potential underlying causes for impulsiveness in this population.

Keywords: Impulsivity, systematic review, forensic, traumatic brain injury, substances, alcohol, trauma, sleep

Abstract word count: 194

1. Introduction

Violent behaviour is considered one of the leading causes of death of individuals aged 15-44 years old and results in significant financial costs to the public (Krug, Mercy, Dahlberg & Zwi, 2002; Butchart, Mikton, Dahlberg & Krug, 2015). For example, the annual cost of violence to society in England and Wales is estimated to be £20 billion (Rutherford, Zwi, Grove & Butchart, 2007), with an estimated global cost of £7 trillion (Hoeffler, 2017).

Violence and aggression are of particular concern to healthcare providers in acute psychiatric and forensic mental health settings, with violent incidents resulting in potential injury to clients and staff, whilst also negatively impacting on treatment delivered by healthcare professionals (Iozzino, Ferrari, Large, Nielssen & De Girolamo, 2015). Bowers et al (2011) found in a review of international studies that overall incidence of violence by service users in inpatient settings was 32.4%. Further still, rates of violent and aggressive behaviour are higher across forensic settings (National Collaborating Centre for Mental Health UK, 2015). Therefore, the assessment of violence risk is a key responsibility of professionals working within criminal justice and forensic mental health settings.

Whilst there are approximately 200 structured tools available for the assessment of violence risk in forensic psychiatric and criminal justice settings, present data suggests most have poor to moderate predictive utility (Douglas, Pugh, Singh, Savulescu & Fazel, 2017) highlighting the challenges to professionals in assessing the multiple precipitants and contextual factors in violent crimes. Structured professional judgement is perhaps the most widely used method to predict future violence, considering dynamic (potential to change) and static (historical or predisposing) risk factors (Hart & Logan, 2011). In their meta-analysis of violent risk factors in psychiatric settings Witt, van Dorn & Fazel (2013) identified that the most robust static factor was the extent of the individuals' criminal past in predicting future violence. However, they revealed a number of significant dynamic factors including hostile behaviour, recent drug misuse, non-adherence with psychological therapies or medication, higher levels of impulsivity, recent substance or alcohol misuse. Therefore, when examining cognitive contributors to violence risk, it is unsurprising that items assessing impulsivity are regularly included in widely used violence risk assessment tools such as the Historical Clinical Risk Management (HCR-20) and Violence Risk Scale (VRS) (Klepfisz, Daffern, & Day, 2016).

Impulsivity is widely recognized as a multidimensional concept, defined as a '*predisposition toward rapid, unplanned reactions to internal or external stimuli without regard to the negative consequences of these reactions to the impulsive individual or to others*' (Moeller, Barratt, Dougherty, Schmitz & Swann, 2001, p. 1784). Perhaps due to the multifactorial nature of impulsive behaviour, there is no unified conceptualization. This has led to a variety of terms being attributed to impulsiveness which can predominantly include *disinhibition, impulsivity, self-control and impulse control* (Stein, Hollander & Liebowitz, 1993; Bari & Robbins, 2013). However, the most widely used models of impulsivity draw upon behavioural and personality theories. Initial personality theories categorized impulsivity as a component of the Five Factor Model's Extraversion factor (McCrea & Costa, 1987). Later research attempted to understand impulsivity as a distinct personality trait, however disagreement of which sub-traits comprise impulsivity has led to many interpretations being proposed. Perhaps most notably, Barratt (1993) conceptualized impulsivity as being an aspect of personality that includes lack of inhibition, sensation seeking and extraversion. Assessment of impulsive personality traits is commonly completed through use of self-report measures such as the Barratt Impulsiveness Scale (Patton, Stanford, & Barratt, 1995) and Eysenck Impulsiveness Scale (Eysenck, Pearson, Easting, & Allsopp, 1985). More recently, behavioural models consider impulsivity as comprised by two distinct components; impulsive choice (risky decision making) and impulsive action (disinhibition) (Reynolds, Ortengren, Richards & de Wit, 2006; Dalley, Everitt & Robbins, 2011). Behavioural aspects of impulsivity are typically assessed using neuropsychological or laboratory measures to examine these state-like impulsive characteristics.

From a neuropsychological perspective, elevated levels of impulsivity are considered a significant risk factor for violent behaviour within forensic populations (Mudde, Nijman, van der Hulst, & van den Bout, 2011). Using a prospective research design, Bousardt, Hoogendorn, Noorthoorn, Hummelen & Nijman (2016) report that self-reported impulsive traits predicted violent behaviour amongst forensic psychiatric inpatients. Furthermore, a recent meta-analysis discovered violent offenders displayed greater impairments on measures of impulsivity than non-violent offenders (Janes, McIntosh, O'Rourke & Schwannaeur, 2018). This supports a view that amongst forensic populations, as an individual's arousal level increases, the inability to inhibit one's impulses may trigger serious aggressive or violent incidents, whilst also demonstrating that impulsivity may hold predictive utility

for reoffending across forensic mental health services (Sedgwick, Young, Das & Kumari, 2016).

Despite strong indications for the relationship between impulsivity and violent behaviour within forensic settings, there appears to be a paucity of research exploring the risk factors for impulsive behaviour within this population. A biopsychosocial approach may hypothesise that factors influencing neurodevelopment and damage to key brain regions involved in the underlying processes of impulsivity would increase the likelihood of impulsive behaviour being displayed (Moeller et al, 2001; Dalley, Everitt, & Robbins, 2011). Dalley and Robbins (2017) review the critical areas within the brain pivotal to impulsivity and conclude that striatal interactions within the prefrontal cortex and hippocampus play a key role in the manifestation of impulsive behaviour.

Beech, Carter, Mann & Rothstein (2017) report that forensic patients have often experienced abuse, neglect, lifestyle factors associated with increased risk of neurological impact (including alcohol misuse, substance misuse and diet) and high rates of traumatic brain injury throughout their lives, all risk factors for potential alteration in the development or structure of brain regions integral to impulsiveness. Spitzer, Chevalier, Gillner, Freyberger & Barnow (2006) found rates of childhood trauma in a forensic population to be between 41-69%. Fazel, Yoon & Hayes's (2017) recent meta-analysis for prevalence of drug and alcohol disorders in prison populations revealed approximately 25% of all newly incarcerated prisoners (both sexes) had an alcohol use disorder and similar rates were found for substance use disorders. Early life emotional trauma and substance or alcohol abuse has been shown to negatively alter neurodevelopment including synaptic organisation of neural pathways (Arden & Linford, 2009). Traumatic brain injury can often result in physical damage to the cerebral cortex, with affected frontal regions specifically linked to violent and criminal behaviour (Williams, 2012). A meta-analysis investigating the prevalence of traumatic brain injury in overall offending populations discovered a rate of approximately 60% (CI: 48.08 to 72.41) (Shiroma, Ferguson & Pickelsimer, 2010).

1.1 Objectives of the current review

It is evident from epidemiological studies that forensic populations may be more susceptible than general populations to experience risk factors assumed to increase the likelihood of impulsive behaviour. The current review aims to systematically

examine the current literature which explores factors associated with impulsivity in forensic settings (Warburton & Stahl, 2016).

2. Method

2.1 Review protocol

The review adopted a standardised protocol submitted to PROSPERO (Centre for Reviews and Dissemination - University of York, 2009) and used as a guideline for the review procedure.

2.2 Search strategy

The primary author conducted an exploratory search to ensure a similar review had not previously been carried out using Google search engine and the Centre for Reviews and Dissemination (University of York). No relevant reviews were identified.

The following electronic bibliographic databases were searched from inception until January 2018: PsycINFO, MEDLINE, EMBASE, and ProQuest Criminal Justice and Social Sciences. Databases were searched using BOOLEAN operators and included searching within full text of article. To ensure a broad inclusion of appropriate search terms for the review, existing articles exploring impulsivity and forensic populations were examined. Reference lists of included papers for review were also searched. Final search terms used were:

- Terms related to impulsivity: “impuls*” OR “impulsiveness” OR “impulsive behaviour”, OR “impulse control” OR “inhibitory control” OR “response inhibition” OR “delay discounting” OR “motor inhibition” OR “disinhibition” OR “motor control”
- Terms related to forensic populations: “forensic psychiatr*” OR “personality disordered offender*” OR “mentally disordered offender*” OR “forensic service” OR “forensic inpatient” OR “forensic mental health” OR “inmates with mental illness” OR “secure unit” OR “forensic psycholog*” OR “secure hospital” OR “prison” OR “convict” OR “offend*”
- Terms associated with empirical studies, specifically predictive research: “predict*” OR “prospective” OR “caus*” OR “associati*” OR “risk” OR “contribut*” OR “factor*” OR “correlat*”

2.3 Study selection criteria

2.3.1 Population

Male and female forensic populations were considered for this review, inclusive of forensic psychiatric and prison settings. Adult and juvenile samples were included. General adult and juvenile mental health samples were excluded as risk factors specific to forensic populations were of interest for the review.

2.3.2 Intervention

Studies were only included in the review if they examined the relationship between a given risk factor and level of impulsivity determined by clinician rating, self-report or behavioural measures.

2.3.3 Outcome

The main focus of the review considered levels of impulsivity as an outcome (dependent variable) using a published clinician rating, self-report or behavioural measure (for example, a computerised or neuropsychological measure) of impulsivity. In the absence of accompanying self-report or behavioural assessments of impulsivity, studies utilising genetic testing or physiological assessments were excluded.

2.3.4 Study design

This review paper considered a wide variety of studies including observational studies, both prospective and retrospective whereby the focus of the study considered risk factors associated with impulsivity in forensic populations. On this basis, between group studies were excluded from final review. Non-English language studies were not considered for the study due to resource limitations.

2.4 Study selection

A PRISMA flow diagram of search results is displayed in Figure.1 depicting the article search and review process. The initial search yielded 5952 studies of which 2066 were duplicates. Titles and abstracts were subsequently reviewed by the author using the study selection criteria outlined above which resulted in 291 remaining studies. Upon full-text review of the remaining articles 9 studies were included for narrative review.

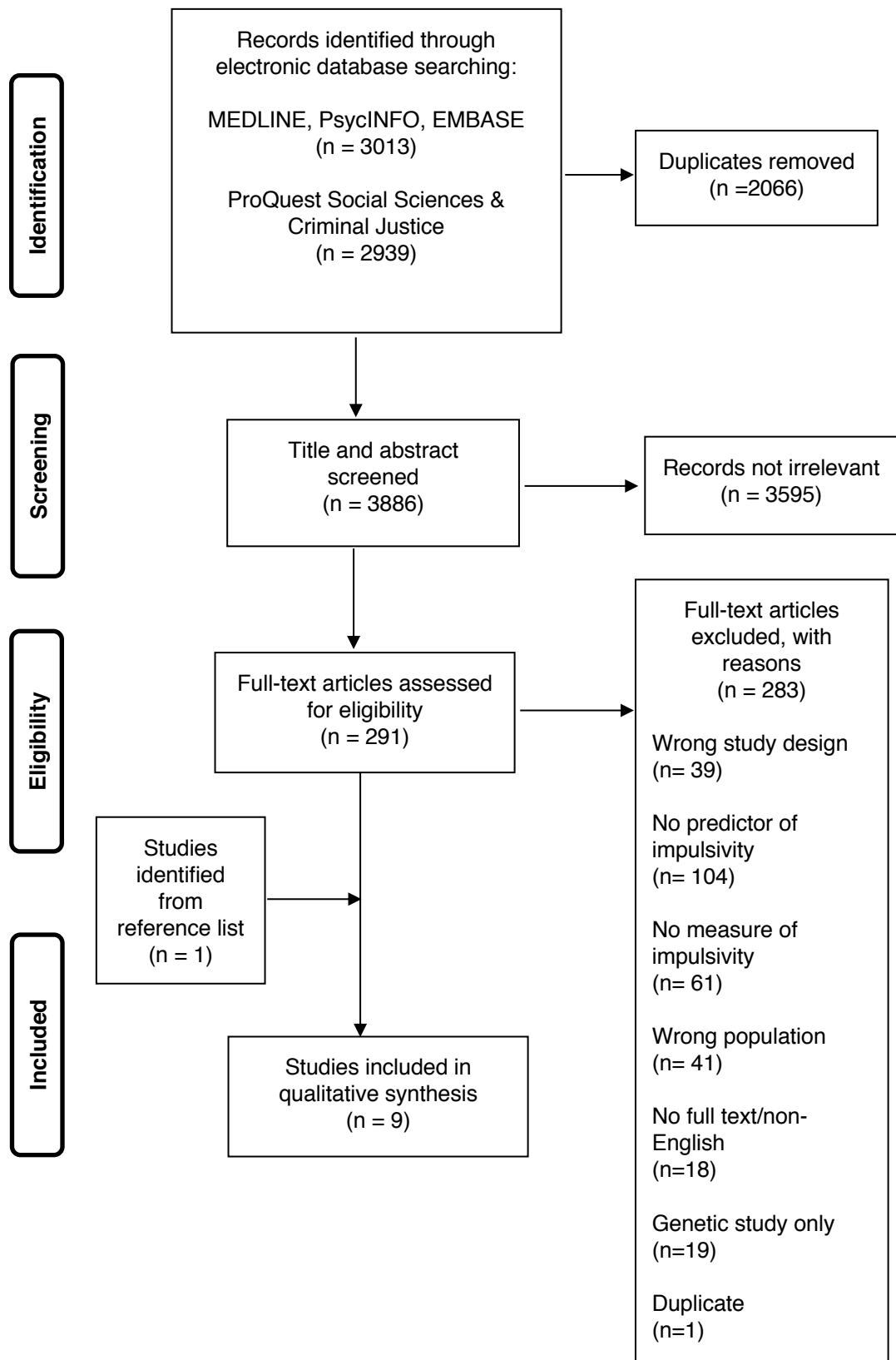
2.5 Quality assessment

In order to assess the quality of studies which met inclusion criteria for the review, the National Institute for Care and Excellence (NICE) Quality Appraisal Checklist for Quantitative Studies Reporting on Correlations and Associations (NICE, 2012), an assessment tool relating to methodological quality was used. This quality tool was tailored to meet the objectives of the review comprising of 13 questions which considered study rationale and objectives; recruitment of participants; validity and reliability of outcome measures and statistical analyses (see Appendix B). Ratings were allocated by the lead author to each aspect of the study using a three-point Likert-scale system depending on whether the criteria were 'not reported' or 'not met', 'partially met' or 'definitely met' before being awarded an overall quality score (maximum score of 26). Total quality scores were converted into a percentage to easily determine the quality of the studies included in the review. Based on arbitrary cut-offs, studies with a quality percentage of 70% or more were considered to be methodologically more robust (see Appendix C). An independent rater assessed two thirds (n=6) of studies included for narrative review to certify that assessment scores were reliable and valid. The subsection of studies assessed by the independent rater were selected using a random number generator. Assessors were observed to agree on 92% of items overall, with a substantial inter-rater agreement level achieved ($k=0.79$) (McHugh, 2012). Consensus was reached through discussion and final ratings agreed upon.

2.6 Data extraction

Information was extracted using a pro-forma which considered inclusion criteria and allowed for systematic recording of key findings. Information extracted included study population, methodology, measure of impulsivity, potential predictor(s) of impulsivity, statistical analyses and key conclusions.

Figure 1. PRISMA flow diagram of the review process



3. Results

3.1 Study characteristics

Nine full text articles met the inclusion criteria. A summary of study characteristics and findings are shown in Table.1. The majority of articles were cross-sectional in design (n=6), with the remaining studies employing a longitudinal design (n=3). All studies were set in forensic settings with participants recruited from a prison population (n=3), adolescent offender population (n=4) and forensic psychiatric population (n=2). The total sample of studies reviewed contained 3733 participants comprised of prison population (n=2080); adolescent offender population (n=1545) and forensic psychiatric population (n=208). The mean age of participants included in the nine studies reviewed ranged from M=15.7 years to M=41.9 years. The majority of participants were male (n=4 studies used male only participants), with total number of male participants n=3630 (97%).

3.2 Methodological review

Quality assessment ratings for included studies can be found in Appendix C. Three studies were categorized as having “good” study quality (Carli et al, 2014; Sergentanis et al, 2014; Van Veen, Karsten & Lancel, 2017) obtaining an overall quality score of $\geq 70\%$. The remaining six studies were deemed as having “acceptable” quality (Bevilacqua et al, 2012; Davis et al, 2017; Kamphuis, Dijk, Spreen & Lancel, 2014; Schwartz, Connolly & Brauer, 2017; Schwartz, Connolly & Valgardson, 2017; Walters & Kiehl, 2015). A number of studies dropped marks due to insufficient information provided to rate specific items as being present, such as recruitment process, inclusion/exclusion criteria and power calculations. However, this may represent poor reporting quality as opposed to methodological flaws. The absence of more objective measures of impulsivity (e.g. neuropsychological or laboratory tasks) also applied to all studies (see 3.3 for details).

Three studies were longitudinal and prospective in design (Davis et al, 2017; Schwartz, Connolly & Brauer, 2017; Schwartz, Connolly & Valgardson, 2017) which may be deemed as more methodologically robust than the remaining six cross-sectional studies Carli et al, 2014; Sergentanis et al, 2014; Van Veen, Karsten & Lancel, 2017; Bevilacqua et al, 2012; Kamphuis et al, 2014; Walters & Kiehl, 2015) in examining the temporal relationship between chosen variables and impulsive behaviour.

None of the included studies provided a-priori power calculation, therefore post-hoc analyses were completed using G Power based on sample size and number of tested variables (McCrum-Gardner, 2010). All studies were powered to detect small-medium effect sizes, with a power level of 0.80 and a significance level of <0.05 (Faul, Erdfelder, Buchner & Lang, 2009). Studies included in the review recruited sample sizes ranging from 96 to 1354.

3.3 Measures of impulsivity

All 9 studies utilized either self-report ($n=8$) or clinician-rating measures ($n=1$). No behavioural or neuropsychological measures of impulsivity were used. In the majority of studies, the Barratt Impulsiveness Scale (BIS) (Barratt, Patton & Stanford, 1995) was used to assess impulsivity ($n=5$). The BIS is arguably the most frequently administered self-report measure used to assess impulsive behaviour, demonstrating good internal consistency (Cronbach's $\alpha = .71$ for total score) and satisfactory test-retest reliability for use in forensic populations (Haden & Shiva, 2008; Stanford et al, 2009). The BIS contains 30 items attending to motor, attentional and non-planning aspects of impulsivity with a recommended cut-off score of ≥ 72 to identify individuals who are highly impulsive (Stanford et al, 2009).

In the remaining studies ($n=4$), subscales from assessment tools focusing on impulsive behaviour were used for analysis: 1) The Disinhibition subscale (4-items examining need for stimulation, lack of realistic long-term goals, impulsivity, and irresponsibility) from the clinician-rated measure, Psychopathy Checklist-Revised (PCL-R - Hare, 1980) was used in one study; and 2) The Impulse Control subscale, drawn from the Weinberger Adjustment Inventory (WAI - Weinberger & Schwartz, 1990) was used in three studies (the 7-item Suppression of Aggression subscale from the WAI was additionally used in one of the reviewed studies). The Impulse Control subscale consists of eight items examining overall behavioural control and demonstrates good internal consistency (Cronbach's $\alpha = .79$) (Knight et al, 2012). The complete assessment tools to which they belong have been found to be valid and reliable in offending populations (Hare et al, 1990; Huckaby, Kohler, Garner & Steiner, 1998).

Table 1. General characteristics of the 9 studies included for full review

Author	Population (Country)	N	Design	Overall quality assessment rating (%)	Impulsivity measure	Total mean impulsivity score
Bevilaqua et al (2012)	Prison (Italy)	411	Cross-sectional study	65	Barratt Impulsiveness Scale (BIS - max score: 120)	47.6 (SD±15.6)
Carli et al (2014)	Prison (Italy)	1515	Retrospective cross-sectional study	73	Barratt Impulsiveness Scale (BIS - max score: 120)	47.3 (SD±14.8)
Davis et al (2017)	Adolescent offender (USA)	1100	Longitudinal study	69	Weinberg Adjustment Inventory (impulse control subscale - max score: 8)	2.92 (SD±0.943)
Kamphius et al (2014)	Forensic psychiatric inpatients (Netherlands)	96	Cross-sectional study	62	Barratt Impulsiveness Scale (BIS - max score: 120)	62.4 (SD±1.2)
Schwartz, Connolly & Brauer (2017)	Adolescent offender (USA)	1354	Longitudinal study	69	Weinberg Adjustment Inventory (impulse control and suppression of aggression subscales - max score: 15)	5.61 (SD±1.74)
Schwartz,	Adolescent offender (USA)	1354	Longitudinal	69	Weinberg	2.96 (SD±0.95)

**Connolly &
Valgardson
(2017)**

study

Adjustment
Inventory (impulse
control subscale -
max score: 8)

Sergentanis et al (2014)	Prison (<i>Greece</i>)	154	Cross-sectional study	77	Barratt Impulsiveness Scale (BIS - max score: 120)	62 (SD±14.9)
Van Veen, Karsten & Lancel (2017)	Forensic psychiatric inpatients (<i>Netherlands</i>)	112	Cross-sectional study	73	Barratt Impulsiveness Scale (BIS - max score: 120)	66.96 (SD±12.08)
Walters & Kiehl (2015)	Adolescent offender (<i>USA</i>)	191	Cross-sectional study	62	PCL-R – disinhibition subscale (max score: 8)	5.41 (SD±1.68)

3.4 Potential predictors of impulsivity

All nine articles included for full-text review contained analyses exploring an association between a chosen predictor (independent variable) and impulsivity (dependent variable). Table 2 (cross-sectional studies) and Table 3 (longitudinal) detail the potential predictors of impulsivity examined, statistical analyses and findings. From the reviewed studies, four main predictors of elevated impulsivity were investigated by researchers; traumatic experiences, head injury, substance misuse (illicit drugs or alcohol) and sleep (sleep quality or sleep disorders).

3.4.1 Trauma

The relationship between traumatic experiences and impulsivity was considered in four studies. Traumatic experiences included childhood trauma/maltreatment (Bevilaqua et al; Carli et al, 2014; Sergeantanis et al, 2014) and victimisation, defined as exposure to violence (Davis et al, 2017).

Two studies found that childhood trauma predicted higher levels of impulsivity (Sergeantanis et al, 2014; Carli et al, 2014), particularly childhood sexual abuse and physical neglect as rated by the Childhood Trauma Questionnaire (CTQ - Bernstein et al, 2003). One study did not identify a significant effect between childhood trauma and impulsivity (Bevilaqua et al, 2014).

The remaining study examined the relationship between victimisation and impulse control (Davis et al, 2017), assessed using the victimisation subscale of the Exposure to Violence Inventory (Selner-Hagan, Kindlon, Buka, Raudenbush & Earls, 1998). Example items on the EVI included whether participants had been subjected to sexual assault or been attacked with a weapon. Overall findings suggest that higher prevalence of victimisation in early life was associated with poorer impulse control across multiple time points throughout adolescence (Davis et al, 2017).

3.4.2 Head injury and neurological investigations

Two studies explored the relationship between head injury and impulse control (Schwartz, Connolly & Brauer, 2017; Schwartz, Connolly & Valgardson, 2017). Both studies drew their sample from the Pathways to Desistance study, a multi-site longitudinal study of adolescent offenders (Mulvey, 2011). In both studies, head injury was assessed using a single self-reported question asking whether the participant had sustained a head injury (12 month prior to baseline and

subsequently at each follow up assessment for the duration of the study) severe enough to result in loss of consciousness or require medical review. In a series of pathway models ($\beta = .08$, $p < .05$), Schwartz, Connolly & Brauer (2017) found early head injury was consistently associated with poorer self-control, as assessed by the Suppression of Aggression and Impulse Control subscales of the WAI. Similarly, Schwartz, Connolly & Valgardson (2017) discovered head injury predicted significant decreases in impulse control ($p < 0.001$) as assessed using the Impulse Control subscale across multiple time points using cross-lagged path model analysis.

In addition, one study included in the review examined the relationship between neurological findings and impulsive behaviour (disinhibition) (Walters & Kiehl, 2015). Findings revealed that lower levels of grey matter volume (GMV) in the hippocampus were significantly associated with increased scores on the Disinhibition subscale of the PCL-R (Hare, 1980), whereas general brain volume and GMV in the amygdala failed to yield a significant relationship with disinhibition scores.

3.4.3 Alcohol and substance misuse

Four studies explored history of alcohol and substance misuse as a predictor for elevated levels of impulsivity (Carli et al, 2014; Davis et al, 2017; Kamphius et al, 2014; Walters & Kiehl, 2015). Alcohol or substance misuse was consistently found to significantly predict impulsive behaviour across all studies which included this variable. However, methods of assessing alcohol or substance use varied greatly across studies. Davis et al (2017) asked participants to respond to a single self-report question related to levels of binge drinking in the past 12 months. In another study, the presence of a substance use disorder was detected through clinical interview by a specifically trained psychiatrist or psychologist (Carli et al, 2014). Kamphius et al (2014) reviewed participants' medical case-files to identify whether a history of substance abuse (e.g. yes/no) was present. Whereas Walters and Kiehl (2015) utilised arguably a more standardised method, administering the Addiction Severity Index (McLellan, Kuskner, Metzger, Peters, Smith, Grissom & Argeriou, 1992), a brief, semi-structured interview relating to psychosocial aspects of a person's substances use.

3.4.4 Sleep

Two studies examined the relationship between sleep quality and/or disorders of sleep with impulsive behaviour (Kamphius et al, 2014; Van Veen, Karsten & Lancel, 2017), measured using the BIS (total scores). In both studies, elevated self-reported levels of impulsivity were significantly predicted by poor sleep quality and insomnia as assessed by the Pittsburgh Sleep Quality Index (Buysee, Reynolds, Monk, Berman & Kupfer, 1989) and the Sleep Diagnosis List (derived from the Sleep Disorder Questionnaire - Douglass, Bornstein, Nino-Murcia, Keenan, Miles, Zarcone & Dement, 1994) respectively. Kamphius et al (2014) also report that a significant relationship could not be found between sleep difficulties and the structured professional judgement of impulsivity.

Table 2. Potential predictors of impulsivity - cross sectional studies

Author(s)	Predictors(s) of impulsivity	Measure(s) used	Statistical analyses	Statistical findings		Comments
				(B)	(P)	
Bevilaqua et al (2012)	1) Childhood trauma	Childhood Trauma Questionnaire (CTQ)	Linear regression	<i>NR</i>	0.29	Within the linear regression model, childhood trauma did not have a significant effect on BIS scores.
Carli et al (2014)	1) Childhood emotional abuse	Childhood Trauma Questionnaire (CTQ)	Non-linear logistic regression	0.00058	5.8485	History of substance use disorders, sexual abuse or physical abuse, predicted higher BIS scores.
	2) Childhood sexual abuse			0.01004	0.0007	
	3) Childhood physical neglect			0.00792	0.0007	
	4) Substance use disorders	Clinical Interview		0.05154	0.0001	
Kamphius et al (2014)	1) Sleep	The Pittsburgh Sleep Quality Index (PSQI)	Multiple regression	0.92	< 0.001	Sleep quality and insomnia significantly predicted subjective impulsivity. A robust relationship between sleep problems and the structured professional judgement of impulsivity could not be confirmed.
		The Sleep Diagnosis List (SDL)		6.26	< 0.001	
	2) History of substance use	History of substance use		5.51	< 0.01	A history of substance abuse was also a significant predictor of impulsivity.
Sergentanis et al (2014)	1) Childhood maltreatment	3-closed questions (≈ 1 cut off)	Multivariate hierarchical regression	<i>NR</i>	0.003	Childhood maltreatment predicted higher rates of impulsivity, as well as aggression, illicit substance and alcohol use, smoking and psychiatric history.

Van Veen, Karsten & Lancel (2017)	1) Sleep	Pittsburgh Sleep Quality Index (PSQI)	Multiple regression	0.742	< 0.01	Sleep quality and insomnia significantly predicted higher rates of impulsivity.
		Sleep Diagnosis List (SDL)		5.223	< 0.001	
Walters & Kiehl (2015)	1) Substance use	Addiction Severity Index (modified version)	Structural equation modelling regression analysis	0.163	0.001	Grey matter volume levels in the hippocampus correlated significantly with disinhibition.
	2) Brain volume			-0.001	0.629	Significant relationship between substance use and disinhibition was also detected.
	3) GMV amygdala	Magnetic resonance imaging (MRI) scans		-0.019	0.891	
	4) GMV hippocampus			-0.436	0.006	

NR - not reported

B - regression coefficient

P - significance value

Table 3. Potential predictors of impulsivity - longitudinal studies

Author(s)	Predictors(s) of impulsivity	Measure(s) used	Statistical analyses	Key findings
Davis et al (2017)	1) Binge drinking	Single self-report question (yes/no)	Auto-regressive latent trajectory with structure residuals model over 7-year period.	Individuals who reported more binge drinking had lower impulse control. Higher victimization also predicted lower impulse control.
	2) Trauma (victimization - exposure to violence)	6-item victimization subscale (Exposure to Violence Inventory)		
Schwartz, Connolly & Brauer (2017)	1) Head injury	Single, self- reported question (yes/no)	Structural equation modeling to examine self-reported head injury as a predictor of starting levels and change in self-control over 7-year period.	Significant associations between head injuries and short-term changes in self-control and subsequent increases in aggressive delinquency.
Schwartz et al (2017)	1) Head injury	Single, self- reported question (yes/no)	Series of autoregressive cross-lagged models in which head injuries at earlier time points were used to predict later measures of impulse control over 7-year period.	The cross-lagged paths consistently demonstrated evidence to suggest that sustaining a head injury was associated with significant decreases in impulse control across multiple time points.

4. Discussion

4.1 Summary of findings

This systematic review is the first to investigate evidence of potential causes for impulsive behaviour in forensic populations. Using a structured search strategy, nine studies were reviewed which adopted research design and statistical analysis examining the relationship between chosen variables and levels of impulsivity. Studies included in this review identified early trauma experiences, sleep, history of substance or alcohol misuse and neurological involvement (e.g. head injury) as potential risk factors for impulsive behaviour in forensic populations.

The assessment of impulsivity in the reviewed studies was confined to self-report and clinician rated measures. Whilst both approaches are widely used and valid methods of assessment in this population, they also possess limitations which should be acknowledged. For example, self-reported measures in forensic populations may be susceptible to patient's under reporting their difficulties, particularly context dependent impulses (Schmidt, Banse & Imhoff, 2015). Potentially due to poor introspective abilities or apprehension of being negatively perceived by others. Whereas, clinician rated measures may be considered more subjective and susceptible to inter-rater reliability issues (Ford, 2005). Of the reviewed studies, there was a lack of neuropsychological or laboratory measures used to examine the state-like behaviour of distinct impulsive components (e.g. response inhibition or delayed gratification) outlined in recent behavioural models of impulsivity.

Findings illustrated that alcohol and/or substance misuse is the most robust and consistently reported risk factor predictive of impulsivity amongst forensic populations (Carli et al, 2014; Davis et al, 2017; Kamphius et al, 2014; Walters & Kiehl, 2015). Impulsive behaviour is strongly linked to drug and alcohol use, however, it may be argued that this relationship is bi-directional in nature. De Wit (2009) hypothesized that impulsivity may simultaneously be a determinant and consequence of substance or alcohol misuse. As a determinant, trait impulsiveness and increases in context dependent state impulsiveness have been shown to increase drug use (Tarter, Kirisci, Feske & Vanyukov, 2007; De Wit, 2009). Acute or long-term effects of drug and alcohol use itself may lead to elevated levels of impulsivity, perhaps due to the impact on neural mechanisms which contribute to

the manifestation of impulsive behaviour. For example, alcohol-related brain damage (ARBD) has been associated with structural changes to the brain and subsequent neurocognitive impairment including executive function deficits of response inhibition, poor planning and self-regulation (Bates, Barry & Bowden, 2002; Zahr, Kaufman & Harper, 2011).

Incidence of head injury significantly predicted increased impulsive behaviour in two reviewed studies (Schwartz, Connolly & Brauer, 2017; Schwartz, Connolly & Valgardson, 2017). Head injury is commonly associated with behavioural, emotional and cognitive changes. These neurobehavioural changes may easily lead to rule breaking behaviour and, as recent literature identifies, individuals in forensic settings are more likely than the general population to have sustained a head injury at some stage in their lives (Williams et al, 2018). It may, therefore be considered surprising that this review yielded only two studies which explored the relationship between head injury and impulsivity in forensic populations, representing a dearth in the current literature. Further knowledge of whether individuals who have suffered a head injury in forensic mental health or other criminal justice settings, experience poorer outcomes or are more likely to engage in offending behaviours may represent opportunities to improve treatment and management options for this subgroup. For example, the National Prisoner Healthcare Network in Scotland (NHS Scotland & Scottish Prison Service, 2016) recommend improvements to the identification of brain injury, as well a consideration of matched care interventions (dependent on severity of brain injury) to help support and manage individuals with brain injury in forensic settings. Additionally, the need for a training analysis to develop resources and highlight education needs for staff working with brain injured clients in forensic settings was also identified.

The findings of this review were inconsistent regarding the relationship between early trauma and elevated levels of impulsivity. However, in other clinical populations early traumatic experiences have been associated with decreased volume in the hippocampal and amygdala regions of the brain (Hoy et al, 2011). In addition, recent research suggests that early trauma adversely impacts cognitive and neural mechanisms responsible for inhibitory control functions (Marshall et al, 2016). Future studies may wish to further explore early trauma and its associations

with distinct components of impulsive behaviour in forensic settings to better understand this relationship.

Sleep difficulties also emerged as a potential cause for impulsive behaviour within forensic psychiatric populations. Research investigating sleep problems with cognitive, behavioural and emotional changes is in its relative infancy. However, a link between poor sleep and behavioural problems may be mediated by the negative impact sleep loss has on the functioning of frontal pathways (Kamphuis, Karsten, de Weerd & Lancel, 2013), and subsequently emotional regulation.

Forensic populations will have often experienced a variety of physical and psychological difficulties throughout the life span (Beech et al, 2017). From the studies included in this review, it is evident that forensic populations may be more likely than general populations to simultaneously experience multiple risk factors thought to increase the likelihood of impulsive behaviour (e.g. poor sleep, history of alcohol/substance misuse, early trauma and head injury), an established predictor of aggressive and violent incidents (Mudde et al, 2011; Bousardt et al, 2016).

It is difficult to draw conclusions as to whether the risk factors that emerged from this review can confidently be considered to cause elevated levels of impulsive behaviour in this population. This is contributed to by the relatively low number of total papers available to review and further still the heterogeneity of variables examined. In addition, aspects of research methodology such as the limited number of studies adopting prospective, longitudinal designs allow less opportunity to determine the temporal relationship between risk factors and levels of impulsive behaviour.

4.2 Strengths and limitations of the current review

The current review is not without limitations, which should be acknowledged. Given the low number of studies for each variable and heterogeneity of studies in relation to methodological design, population group and forensic setting, there were insufficient data for meta-analytic analyses. A second limitation is that in an effort to be inclusive of all forensic populations (including prison, young offender and forensic psychiatry), this could potentially result in consequent problems of generalisability due to findings from one forensic setting (e.g. young offenders) perhaps not

automatically translating to another (e.g. prison). For example, research examining developmental trajectories of impulsive behaviour indicate higher baseline levels to be present in adolescence and gradually declining thereafter (Monahan, Steinberg, Cauffman & Mulvey, 2009). A third limitation relates to the quality assessment adopted and use of percentage ratings to summarise the overall quality of each study. This approach was taken to assist the reader's interpretation of study quality, however cut-off scores used to categorise study robustness were arbitrary. Finally, there is potential for a cultural bias as non-English studies were excluded from this review.

Regarding strengths of this review, it should be noted to date this is the first systematic review to offer a narrative synthesis of potential causes for elevated impulsiveness in forensic settings. This study was strict in its inclusion of studies that adopted an associative research design which ultimately reduced the number of papers for final review, however which were more able to elucidate the causes for impulsive behaviour in this population. In addition, efforts were made to improve the quality assessment process through use of a second independent rater, whereby a substantial level of agreement was achieved.

4.3 Implications for future research and clinical practice

There is a dearth of research exploring the relationship between risk factors for impulsive behaviour which adopt prospective, longitudinal methodology and robust outcome measures assessing the distinct components of impulsivity as outlined in recent models (Reynolds et al, 2006; Dalley et al, 2011). There was a notable absence of more objective, behavioural assessment methods utilised in the reviewed studies which may offer an opportunity for future research to examine predictive factors of state-like impulsive behaviours in addition to routinely assessed trait impulsiveness.

The findings of the current review may assist healthcare or criminal justice professionals working in forensic settings and involved in assessing risk. Structured professional judgement tools often accommodate items relating to impulsive behaviour, further knowledge of potential underlying causes for impulsiveness may assist in identifying this as a risk factor for clients. Future research may wish to explore whether impulsivity plays a mediating role between risk factors of a

neurological basis (e.g. TBI) and violence. Additionally, there is a paucity of studies estimating the prevalence of impulsivity in forensic populations, which could offer a larger scale opportunity to examine its correlates and potential causes.

4.4 Conclusions

This is the first systematic review to examine potential causes of impulsivity in forensic settings. The conclusions of which are confounded by a limited number of studies examining a range of variables and the research design adopted to examine relationships with impulsive behaviour. Risk factors for impulsive behaviour which emerged from the review were alcohol or substance misuse, head injury, early trauma and sleep. Further research examining risk factors for impulsivity may wish to adopt longitudinal, prospective methodology utilising more objective, behavioural assessment methods to measure the distinct aspects of impulsivity in line with recent theoretical models of impulsivity.

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An investigation into behavioural impulsivity in forensic mental health units: a comparison of the predictive validity of instruments to identify violence and antisocial behaviours

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Abstract

Purpose: Impulsivity is widely recognised as playing a significant role in violent and antisocial behaviour. This study sought to compare the predictive utility of widely used measures of impulsivity in detecting violent and antisocial behaviour within a forensic mental health inpatient population.

Method: A cross-sectional study adopting a retrospective and prospective design was conducted with 43 participants, all inpatients in forensic mental health settings. Data was collected from clinician rating, self-report and behavioural measures of impulsivity. Relationships between these variables and violent and antisocial behaviour were analysed using regression and receiver operating curve analyses.

Results: Consistent with existing research, results revealed a significant positive relationship between levels of impulsivity and violent and antisocial behaviour. Clinician rating and self-reported measures of impulsivity appeared to be most sensitive in detecting future incidents of violence and antisocial behaviour.

Conclusions: This is the first study to compare the predictive utility of multiple assessment methods for impulsivity in identifying violent and antisocial behaviour within UK forensic mental health inpatient settings. Findings suggest clinician rating of impulsive behaviour may be supplemented by the use of self-reported impulsivity in the context of risk assessment.

Keywords: Impulsivity, forensic mental health, violence, offending, assessment

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1. Introduction

1.1 Violent and antisocial behaviour

There is growing interest in the research literature identifying antisocial and violent behaviour as a significant public health concern (Krug, Dahlberg, Mercy, Zwi, & Lozano, 2002; Fazel, Singh, Doll & Grann, 2012) with violence-related morbidity and mortality responsible for 3% of the global burden of disease (Brundtland, 2002). In the UK, violence and antisocial behaviour is estimated to cost the NHS approximately £2.9 billion every year (Bellis, Hughes, Perkins, & Bennett, 2012). A meta-analysis by Fazel, Gulati, Linsell, Geddes & Grann (2009) revealed the risk of violent outcomes was significantly increased in individuals with schizophrenia and other psychoses in comparison to the general population. Indeed, mental health problems are more common amongst people in the criminal justice system, with a higher rate of diagnosis for psychoses and personality disorder in forensic services (Joint Commissioning Panel for Mental Health, 2013). Within acute forensic psychiatric settings, a number of risk factors have been identified for inpatient violence most notably male gender, substance abuse and lifetime history of violence (Iozzino, Ferrari, Large, Nielssen & de Girolamo, 2015). In addition, severe mental ill health can be understood as a fluctuating dynamic risk factor for violence or reoffending (Douglas, Guy & Hart, 2009).

1.2 Impulsivity and violent or antisocial behaviour in forensic populations

Impulsive behaviour is central to multiple psychopathologies and included as part of the DSM-V diagnostic criteria for antisocial personality, borderline personality and attention deficit disorders (American Psychiatric Association, 2013). From a neuropsychological perspective, high levels of impulsivity are perhaps one of the strongest clinical predictors of violence and engagement in antisocial behaviours. The current literature suggests a strong relationship between impulsive behaviours and increased incidents of violence and antisocial behaviour within forensic settings (Mudde, Nijman, van der Hulst, & van den Bout, 2011; Gordon & Egan, 2011; Witt, van Dorn & Fazel, 2013; Tonnaer, Cima & Arntz, 2016) and specifically in individuals with diagnoses of borderline personality disorders (González, Igoumenou, Kallis, & Coid, 2016) and psychosis (Cornaggia, Beghi, Pavone, & Barale, 2010). Indeed, items which consider an individuals' level of impulsiveness are often included in violence risk assessment tools (Klepfisz, Daffern, & Day,

2016). However, the ability of commonly used tools in detecting future violence has been found to vary, for example the Historical Clinical Risk Management-20 (HCR-20), which is widely used across forensic mental health settings in NHS Scotland. This may suggest a need to improve the predictive validity of violence risk assessment methods (Douglas, Pugh, Singh, Savulescu & Fazel, 2017).

1.3 Models of impulsivity

Impulsivity is considered a complex and multidimensional personality construct that may be defined as *'behaviour without adequate thought, the tendency to act with less forethought than do most individuals of equal ability and knowledge, or a predisposition toward rapid, unplanned reactions to internal or external stimuli without regard to the negative consequences of these reactions.'* (International Society for Research on Impulsivity; www.impulsivity.org). Early theories of impulsivity (Eysenck and Eysenck, 1968; Whiteside and Lynam, 2001; Barratt, 1993) have historically explored impulsivity as a personality trait with self-report measures used to test these hypotheses. In contrast, state-like impulsivity, typically assessed using behavioural measures, refers to the individual's transitory state at a particular time in response to a particular event or environmental condition. There are a number of behavioural models proposed to reflect the multidimensional nature of impulsivity which consistently suggest the following distinct aspects must be considered when explaining impulsive behaviour; (1) motor inhibition (impulsive action); the ability to inhibit a spontaneous action once it has been initiated, and (2) impulsive decision making (impulsive choice); the ability to sacrifice more immediate rewards in favour of preferred longer term goals (Reynolds, Ortengren, Richards & de Wit, 2005; Dalley, Everitt and Robbins, 2011). In an attempt to explain the neural basis for impulsivity, Dalley and Robbins (2017) propose that striatal interactions within the prefrontal cortex and hippocampus are instrumental. More recently efforts have been made to consider the role of impulsivity specifically within the context of forensic settings. Tonnaer, Cima & Arntz (2016) suggest a three-dimensional model of impulsivity to explain impulsive actions in offending populations, encompassing the principles included in dual system models, with an additional focus on sensation seeking in relation to actual risk taking. Due to the complex and multifaceted nature of impulsivity, it is evident from the current literature that a unified definition and explanation of impulsive behaviour is still lacking.

1.4 Assessment of impulsivity

Impulsivity is recognised as being a significant cognitive predictor of violence (Brugman et al, 2016). It is considered in violence risk assessments as a dynamic risk factor (Hart & Logan, 2011). In this format, assessment of impulsive behaviour is often completed either through structured professional judgement (SPJ), with the aid of criteria to help identify the presence of a particular risk factor; or clinical judgement, which may be completed without use of a specific objective measure of impulsiveness (Douglas, Hart, Webster, & Belfrage, 2013). The use of supplementary self-report or behavioural measures to assess impulsivity may assist clinicians in their evaluation of an individual's impulsiveness and potentially improve predictive utility of overall violence risk assessment.

Existing literature suggests impulsivity is primarily assessed using self-report or clinician ratings (Matusiewicz, Reynolds & Lejuez, 2011). Self-report measures are quick to administer and may encourage the individual to reflect and gain a greater understanding of their behaviour. However, there are limitations to this method of assessment including the impact of poor self-evaluation skills or of unwillingness to disclose information that may be perceived negatively by others. Additionally, this approach to measuring impulsivity is relatively less sensitive to state changes in behaviour as it evaluates self-perceptions of behaviour rather than the behaviour itself (Matusiewicz, Reynolds & Lejuez, 2011). Objective neuropsychological or behavioural measures may offer a more accurate evaluation of an individual's impulse control (Mathias, Marsh-Richard & Dougherty, 2008). However, a limitation of behavioural assessment tools is the lack of normative data available for use in forensic settings. In addition, this assessment approach can prove time-consuming for clinicians (Matusiewicz, Reynolds & Lejuez, 2011).

1.5 Aims of the current study

From a neuropsychological standpoint, impulsivity is considered to play a key role in violent and antisocial behaviour. In addition, current literature identifies a need to improve the predictive validity of violence risk assessment tools (Douglas, Pugh, Singh, Savulescu & Fazel, 2017). Therefore, the current study will explore the use of commonly used behavioural and self-report measures in detecting levels of behavioural impulsivity with forensic psychiatric inpatients drawn from multiple secure units across Scotland. This study aims to compare the predictive validity of impulsivity measures for a) violence and b) other antisocial behaviours for this population. The findings may be clinically useful as there are currently no explicit

recommendations for health professionals working within forensic mental health settings as to how this particular risk factor (behavioural impulsivity) can be assessed reliably with potential implications for the accuracy of its recording. It is hoped the findings of the study will assist forensic mental health professionals when assessing behavioural impulsivity as part of a wider SPJ approach to risk assessment for this population. We hypothesise that the addition of one or more structured or behavioural measures of impulsivity may significantly improve the predictive utility of item C4 (HCR-20v3) in detecting violent and antisocial behaviour. In line with the current literature, we expect that raised levels of impulsivity on behavioural and self-report measures will predict an increased incidence of violence and antisocial behaviour in Scottish forensic psychiatric inpatients.

2. Method

2.1 Design

A within-subjects cross sectional design with combined retrospective and prospective analysis was used to examine the predictive validity of widely used measures of impulsivity in identifying which forensic mental health inpatients are at greater risk of displaying violent and antisocial behaviour over a particular time frame.

2.2 Participants

The study recruited participants from four NHS Scotland forensic hospitals; The State Hospital, Rohallion Clinic (NHS Tayside), Rowanbank (NHS Greater Glasgow & Clyde) and Radernie Unit (NHS Fife). The State Hospital is Scotland's only high security hospital, Rohallion and Rowanbank provide both medium and low security, whilst Radernie Unit provides low security. All sites provide care and rehabilitation to patients detained under the Mental Health (Care and Treatment) (Scotland) Act (2003) who have displayed high risk behaviours which had at least the potential to endanger other people. Patients are admitted from Scotland and Northern Ireland, prisons, courts, higher and lower levels of security and the community.

Participants were required to be male, over the age of 18 years old and able to provide informed consent to participate in the study as determined by the individuals Responsible Medical Officer (RMO). Exclusion criteria for the study included a diagnosis of a learning disability and non-English speakers.

2.3 Measures

Independent variables

2.3.1 Behavioural measures of impulsivity

GoStop Impulsivity Paradigm (GoStop - Dougherty, Mathias, Marsh & Jagar, 2005)

The GoStop is a computerised response disinhibition procedure for assessing the ability to inhibit an already initiated response. More impulsive individuals have diminished ability to inhibit already initiated responses and, therefore, when eliciting and inhibitory cues are paired, a response is emitted more frequently than inhibited. Like other stop tasks, the participant attends to a series of visual stimuli (e.g. a string of digits) and must either respond when a 'go' signal appears or withhold a response when a 'stop' signal appears. Identical numbers are classed as "go" trials (numbers presented in black for the full 500ms), whereas "stop" trials are numbers that change from black to red at one of four predetermined delays: 50, 150, 250, or 350ms after stimulus presentation. Previous research has identified that GoStop 150ms scores discriminate between impulsive and control groups (Dougherty et al, 2005. Dougherty et al, 2009). Data for this trial was analysed as a continuous variable for the purpose of this study.

Two Choice Impulsivity Paradigm (TwoChoice - Dougherty, Mathias, Marsh & Jagar, 2005)

The TwoChoice is a computerised task designed to measure the consequence sensitivity aspect of impulsivity. This task taps into non-planning impulsivity, with more impulsive responses demonstrating a preference for smaller-sooner gains in favour of an overall larger-later reward (Dougherty et al, 2003). In the TCIP, participants experience the rewards and delays in real-time by responding to visual stimuli on screen. This measure is a continuous variable with total number of immediate reward choices as the primary data collected.

Balloon Analogue Risk Task (BART – Lejuez, Read, Kahler, Richards, Ramsey, Stuart & Brown, 2002)

The BART is a computerised measure of actual risk taking. Participants have the opportunity to win or lose points. As the task progresses and the individual repeatedly responds to stimuli, this results in increasing gains whilst simultaneously increasing the risk of loss on each trial. To date, poor performance on the BART has been found to correlate with actual risk-taking behaviour, predominantly in alcohol

and substance misuse populations (Lejuez et al, 2002). Reliability of the BART has also been examined revealing strong reliability (>0.70), with a reasonably robust test-retest correlation ($r = 0.77$) also evident (White, Lejuez, & de Wit, 2008; Lejuez et al, 2002). This measure is a continuous variable with the primary score used to measure BART performance as the average number of pumps completed by the participant, with higher scores indicating greater risk-taking.

2.3.2 Self-report measure of impulsivity

Barratt Impulsivity Scale-Version 11 (BIS-11 - Patton, Stanford & Barratt, 1995)

The BIS-11 comprises 30 items and adopts a four-point Likert scale format. The BIS is the most widely used psychometric measure of impulsivity (Stanford et al, 2009). Patton, Stanford & Barratt (1995) recommend that total score received on the BIS-11 provides adequate internal consistency amongst general, psychiatric and prison populations with Cronbach's alpha coefficients ranging between 0.79-0.83. A recommended cut-off of ≥ 72 is proposed to indicate problematic impulsive behaviour (Stanford et al, 2009). Total BIS scores were used for analysis as a continuous variable.

2.3.3 Risk Assessment

The Historical Clinical Risk Management-20, Version 3 (HCR-20 v3 - Douglas, Hart, Webster, & Belfrage, 2013)

The HCR-20v3 is a detailed set of professional guidelines for the assessment and management of violence risk incorporating a structured professional judgement (SPJ) approach to risk assessment. This tool consists of ten historical risk factors (e.g. history of problems with violence), five relevant clinical factors (e.g. recent problems with insight) and five items reflecting the individual's ability to adhere to risk management strategies (e.g. future problems with professional services and plans). The HCR-20v3 is used widely across NHS Scotland and information contained within this assessment is accessible as part of participant's clinical case-notes. Data collected from the HCR-20v3 and case notes provided background information for participants. Of particular interest was item C-4 (*Recent Problems with Instability*) ratings obtained from the participants' most recent HCR-20v3 which assesses the individuals' ability to maintain stable adjustment with respect to current functioning considering behaviourally impulsive behaviour. The reason for investigating the global rating for instability (item C4) is due to a lack of consistency

in healthcare professionals across NHS Scotland secure settings explicitly scoring sub-categories of instability (e.g. cognitive, affective and behavioural instability). Item C4 of the HCR-20v3 requires clinicians to record the extent to which instability has been assessed as present for the individual in the past review period. Self-report and behavioural measures were completed in conjunction with participants most up to date HCR-20v3 ratings. Therefore, subsequently influencing item C4 ratings provided for analyses given this will be based on retrospective incidents of violence and antisocial behaviour. However, this data will be included for comparison with other measures and particularly pertinent for prospective analyses. This data shall be coded 0=not present/partially present or 1=present for the purpose of analysis.

Dependent variables

2.3.4 Assessment of violent and antisocial behaviour

DATIX reports and patient case-notes

DATIX is a computerised risk management system widely used by all healthcare professionals across NHS Scotland. Each site's risk management departments compiled DATIX incidents for each participant for the researcher to use as outcome data. In addition, patient case-notes were searched as per the study protocol to detect all incidents of antisocial or violent behaviour as documented by clinical staff during the participants' admission for the study review period.

Social Dysfunction and Aggression Scale (SDAS – Wistedt, Rasmussen, Pedersen, Malm, Träskman-Bendz, Wakelin & Bech, 1990)

The SDAS (Wistedt et al, 1990) is a nine-item rating scale used by the researcher to code DATIX reports and documented incidents from patient case-notes. The SDAS measures the presence of antisocial and aggressive behaviour ranging from mild to severe including uncooperative, provocative, verbally or physically aggressive and violent behaviours. Additionally, this standardised measure of antisocial and violent behaviour was selected to ensure consistency in the coding of information from DATIX and patient case-notes across the different recruitment sites. The SDAS adopts a Likert-scale format for recording responses and is estimated to take 5-10 minutes to complete. This measure has been found to possess good reliability with a Cronbach's alpha of 0.79 (Wistedt et al., 1990). Additionally, Kobes, Bulten &

Nijman (2012) report the SDAS as a sensitive measure in recording mild to severe aggressive behaviours in a forensic psychiatric inpatient population.

2.4 Procedure

2.4.1 Ethical approval

This study was reviewed and granted ethical approval from the Forensic Network Research Committee, NHS West of Scotland Research Committee 4, site specific research and development committees and the University of Edinburgh School of Health in Social Science research ethics committee (REC reference: 17/WS/0070).

2.4.2 Data collection

At each research site relevant RMOs were contacted and asked to identify patients who meet the inclusion criteria for the study. A member of the patient's usual care team approached the patient to provide a participant information sheet (Appendix F) and to explain the basis of the study. If the individual expressed an interest to proceed with participation, the lead researcher arranged an appointment to meet with the patient in order to proceed with the process of obtaining informed consent (Appendix G). Participants then completed all self-report and behavioural measures of impulsivity in one session totalling approximately 40 minutes. Demographic information was also collected at this stage from the participants' case-notes.

Information was collected for each participant for all violent and antisocial behaviours 12 months prior and up to 6 months (minimum 3 months) following the administration of impulsivity measures through review of the DATIX Incident Report System. Patient weekly progress notes and summaries, as recorded by nursing staff, were also reviewed to ensure all incidents were included for use as outcome data. All incidents contained in the DATIX Incident report system, patient weekly logs and progress notes were subsequently transferred and coded to the Social Dysfunction and Aggression Scale (Wistedt et al, 1990) which acted as the study's outcome variable.

2.5 Analytical plan and statistical tests

2.5.1 A-priori sample size calculation

A-priori sample size calculation was completed using G-Power with an assumed power of 0.8 and an error value of 0.05 (Faul, Erdfelder, Buchner & Lang, 2009).

Calculations suggested for hierarchical multiple regression analyses with 5 predictor variables it was necessary to recruit 43 participants to detect a large effect size ($f^2=0.35$) and 92 participants would be required to detect a medium effect size ($f^2=0.15$).

2.5.2 Primary analysis

The primary aim of the study was to compare the predictive validity of selected methods of assessing impulsivity in detecting incidents of violent and antisocial behaviour. Firstly, univariate analyses were planned to assess the individual ability of behavioural (BART, GoStop & TwoChoice), self-report (BIS-11) and clinician rating (item C4, HCR-20v3) impulsivity measures to explain variance of the dependent variable. Furthermore, a hierarchical regression model would be performed based on findings of preliminary univariate regression analyses to determine whether the addition of self-report or behavioural measures would supplement the predictive accuracy of HCR-20v3 item C4 in identifying violent and antisocial behaviour (Field, 2013). Total scores from behavioural, self-report and clinician rating measures of impulsivity were entered into regression models for analysis with higher scores indicating higher levels of impulsivity.

2.5.3 Secondary analysis

Secondary analyses were planned to compare clinician rated, behavioural and self-report measures of impulsivity using correlation co-efficient and areas under the receiver operating curves (AUROC). It was deemed this would assist in determining whether clinicians would benefit from using a standardised measure of impulsivity in addition to existing risk assessment methods. Swets's (1988) suggests the following AUC critical values as a guideline for interpreting ROC curve data; AUC > 0.90 and above (excellent), AUC > 0.81 to 0.89 (good), AUC > 0.70 to 0.79 (moderate); AUC > 0.60 to 0.69 (poor), AUC > 0.50 to 0.59 (failing to predict).

Additional correlational analyses were planned to explore whether associations exist between other clinical risk factors collected known to contribute to cognitive impairment as part of demographic information (including TBI, history of substance or alcohol misuse and psychiatric diagnosis) and increased impulsivity. Finally, dependant on available data regression analyses were planned for a sub-sample of participants with full HCR-20v3 available to explore whether measures of impulsivity would supplement total HCR-20v3 scores in predicting levels of violent and

antisocial behaviour. All statistical analyses were completed using SPSS version 23 (IBM, 2015).

3. Results

3.1 Sample characteristics

Table 1 outlines the general characteristics for participants included in the study. Across the four secure units, 125 patients were deemed to meet inclusion criteria for the study by relevant RMO's. 81 patients declined to participate (65%) resulting in a total of 44 participants being recruited to the study, however one participant chose to withdraw from the study prior to completing any of the research tasks. Therefore, the total sample consisted of 43 males. The majority of participants were recruited from a high secure hospital setting (n=25), the remainder of the sample comprised of patients from medium secure (n=10) and low secure (n=8) hospital settings.

Within the sample, the most prevalent psychiatric diagnosis was schizophrenia (70%). A third of the sample held a personality disorder diagnosis, often in addition to an existing psychiatric diagnosis. Additionally, a range of health conditions could be found in this sample, with a diagnosis of diabetes given to almost one third of participants (28%).

There was some overlap noted in participant's index offences. These primarily related to physical violence; murder (37%) and serious assault (44%). The remaining index offences related to sexual assault (19%) and arson (7%). In addition, a lifetime history of violence as recorded in the individuals most recent risk assessment was prevalent in n=39 participants (91%).

A history of problems with alcohol or illicit substances were present in the majority of participants (84%). In addition, participants were administered the Brain Injury Screening Index (BISI) to standardise self-reported incidence of traumatic brain injury. 42% of participants reported having suffered some form of brain injury ranging from mild to severe.

Table 1. Sample characteristics

	Total Sample (n=43)	
	N	%
Diagnoses		
Schizophrenia	30	70
Schizoaffective disorder	5	12
Bipolar disorder	2	5
Substance related disorder	3	7
Personality disorder	14	33
PTSD	1	2
TBI	1	2
Health conditions		
Diabetes	12	28
Cardiovascular problems	4	9
Cardiac problems	3	7
Respiratory problems	4	9
Neurological (including epilepsy, MS)	2	5
Blood borne virus	4	9
Index offence		
Murder	16	37
Serious assault	19	44
Sexual assault	8	19
Arson	3	7
History of violence prior to IO		
Yes	39	91
Self-reported TBI		
None	25	58
Mild - Moderate	15	35
> Severe	3	7
History of problems with alcohol or illicit substances		
Yes	36	84

3.2 Mean scores on impulsivity measures

In this sample the average BIS total score was 64.05 (SD=10.40), with 21% of participants scoring above the recommended cut-off score of ≥ 72 (Stanford et al, 2009). Mean scores for behavioural measures GoStop (Stop Latency 150ms), TwoChoice (total Immediate Responses) and BART (total pumps) are also provided in Table 2.

Regarding missing data, a proportion of participants (n=6) did not have an HCR-20v3 violence risk assessment completed either due to the nature of their index offence warranting an alternative method of risk assessment, or an HCR-20v3 had not yet been formulated by the care team in time to be included for analysis. In this scenario, the participant's lead psychologist, who knew them well, was contacted and provided the HCR-20v3 manual guidance information to rate item C4 (recent problems with instability) for research purposes only.

Table 2. Total mean scores for self-report and behavioural measures of impulsivity

	N	Mean (SD)
BIS	43	64.05 (10.40)
GoStop	42	237.16 (114.67)
TwoChoice	43	11.72 (6.89)
BART	42	677.21 (277.26)
HCR-20 (item C4)	43	0.35 (0.48)

Note: a lower sample size is observed for the GoStop and BART measures due to a single participant having restricted physical abilities which limited their capacity to perform these tasks.

3.3 Correlations between impulsivity measures and background characteristics

Total scores on the BIS were significantly associated with behavioural measures; GoStop ($r=0.41$, $p<0.05$) and BART ($r=-0.31$, $p<0.05$). No significant associations were observed between behavioural measures of impulsivity (Table 3). An isolated significant association between scores on the TwoChoice behavioural measure and lifetime history of violence was observed ($r=-0.34$, $p<0.05$), no other measures of impulsivity were found to correlate with background characteristics. Additionally, a significant correlation was observed between history of substance or alcohol misuse with a prior history of violence ($r=0.38$, $p<0.05$).

Table 3. Correlation coefficient between self-report or behavioural impulsivity measures and background characteristics

	BIS	GoStop	TwoChoice	BART	HCR-20 (item C4)
Impulsivity measure					
BIS	-	0.41*	-0.03	-0.31*	0.13
GoStop	-	-	-0.27	-0.16	0.15
TwoChoice	-	-	-	-0.12	-0.24
BART	-	-	-	-	0.06
Background factors					
Lifetime history of violence	-0.16	0.03	-0.34*	-0.08	0.07
History of substance abuse	0.09	0.13	-0.15	0.15	0.27
Self-reported TBI	0.09	0.14	0.15	-0.14	0.03

* $p < 0.05$

3.4 Retrospective analysis

Statistical analysis was completed exploring the relationship between participants' scores on impulsivity measures and incidents of antisocial or violent behaviour as captured from SDAS scores for the 12-month period prior to recruitment to the research study.

3.4.1 Regression analysis for impulsivity measures as predictors of antisocial and violent behaviour

Based on the a-priori sample size calculation the following regression analysis is powered to detect a large effect size ($f^2=0.35$), due to the number of participants recruited ($n=43$).

Assumptions for regression were met for univariate and hierarchical analyses. Collinearity statistics included variation inflation factor (VIF) which should not exceed 10 and tolerance statistic which lie above 0.2 (Field, 2009). Observed statistics for collinearity ranged between .856-.960 for tolerance and 1.042-1.168 for the VIF statistic, suggesting multicollinearity was not of concern. Normal

probability plots revealed data to adhere adequately to the line of best fit suggesting normal distribution of variables. Scatter plots revealed that assumptions of linearity and homoscedasticity were met. Mahalanobis distance values were reviewed and critical value tables referred to for the presence of outliers across univariate and hierarchical regression analyses, which revealed a single case marginally above the recommended critical values (Barnett & Lewis, 2004).

Preliminary univariate regression analyses were performed (Table 4) to assess relationships between impulsivity measures and variance of violent and antisocial behaviour, which would inform further hierarchical multiple regression analyses. Higher scores on TwoChoice ($\beta=-0.36$, $p<0.05$) and item C4 (HCR-20v3) ($\beta=0.45$, $p<0.01$) predicted violent and antisocial behaviour in the 12 months prior to participation in the study. Elevated scores on the GoStop behavioural measure of impulsivity were observed to be nearing significance ($\beta=0.22$, $p=0.07$), whereas a significant relationship was not found between participants scores on the BIS or BART with retrospective outcome data.

Table 4. Univariate regression analysis for impulsivity to predict antisocial and violent behaviour (total retrospective SDAS scores)

	<i>R</i> ²	B	SE	β	95% CI
BIS	0.07	2.13	1.21	0.27	-0.31-4.58
GoStop	0.08	0.22	0.12	0.27	0.02-.04
TwoChoice	0.13	-4.36*	1.77	-0.36	-7.93--0.80
BART	0.01	-0.03	0.05	-0.11	-0.13-0.06
HCR-20 (item C4)	0.20	77.10*	24.21	0.45	28.10-126.01

Abbreviations: B, unstandardized regression coefficient; SE, standard error of regression coefficient; β , standardized beta coefficient 95% CI, 95% confidence interval.

* $p<.05$

Hierarchical multiple regression analysis was used to test the incremental validity of selected measures of impulsivity (IV) when added to item C4 (HCR-20v3) to significantly predict participants' levels of antisocial and violent behaviour (DV) as captured through SDAS scores for the 12-month period prior to participants' recruitment to the study. Item C4 (HCR-20v3) was initially inputted into the model

followed by TwoChoice and GoStop measures, guided by univariate regression analyses, to explore whether delayed discounting or response inhibition supplemented clinician rating of impulsive behaviour in explaining variance of violent and antisocial behaviour (Table 5). A significant change in the overall model was not observed through addition of behavioural measures to item C4 (HCR-20v3), however Model 3 which contained all three predictors accounted for the largest amount of variance for violent and antisocial behaviour, 29% (Adj $R^2=0.23$) and the equation remained significant ($F_{(3,39)}=5.22$, $p<0.01$).

Table 5. Hierarchical multiple regression analysis for impulsivity to predict antisocial and violent behaviour (total retrospective SDAS scores)

	Model 1			Model 2			Model 3		
Variable	<i>B</i>	<i>SE</i>	β	<i>B</i>	<i>SE</i>	β	<i>B</i>	<i>SE</i>	β
HCR-20 (item C4)	77.05	24.24	0.45	66.04	24.14	0.38	64.41	24.16	0.37
TwoChoice				-3.28	1.69	-0.27	-.2.73	1.77	-0.23
GoStop							0.12	0.12	0.15
R^2			0.20			0.27			0.29
Adj R^2			0.18			0.23			0.23
F			10.10			7.28			5.22
Sig F Change			<0.01			0.06			0.31
P value			<0.01			<0.01			<0.01

Abbreviations: B, unstandardized regression coefficient; SE, standard error of regression coefficient; β , standardized beta coefficient.

3.4.2 Sensitivity and specificity of impulsivity measures to detect violent and antisocial behaviour in an inpatient setting

Receiver Operating Curve (ROC) analysis was completed to investigate the sensitivity and specificity of impulsivity measures in detecting physically violent behaviour as captured using 12-month retrospective SDAS data. Analysis used the presence of physical violence (0=no; 1=yes) coded from scores on items 7-9 of the SDAS as the state variable for analysis. The area under the curve (AUC) indicated that the majority of individual measures of impulsivity failed to predict

physical violence conducted by mentally disordered offenders significantly better than chance (Table 6). Total BIS scores (AUC=0.67) and clinician rated HCR-20v3 item C4 (AUC=0.60) were most reliable, albeit demonstrating poor predictive validity in forecasting physical violence in this sample according to Swet's (1988) recommended critical values.

Table 6. ROC curve analysis for measures of impulsivity detecting retrospective violent behaviour in secure inpatient settings

	AUC	SE	95% CI
BIS	0.67	0.09	0.49-0.84
GoStop	0.50	0.11	0.29-0.71
TwoChoice	0.46	0.10	0.27-0.66
BART	0.37	0.09	0.19-0.54
HCR-20 (C4 item)	0.60	0.09	0.42-0.79

Abbreviations: AUC, area under the curve; SE, standard error; 95% CI, 95% confidence interval.

A further ROC curve analysis was performed to test the sensitivity and specificity of impulsivity measures in detecting verbally aggressive behaviour in addition to physically violent behaviour throughout the 12-month period prior to participants' recruitment to the study (Table 7). Presence of verbally aggressive behaviour and physical violence was coded (0=no; 1=yes) from participants' scores on items 5-9 of the SDAS, used as the state variable for analysis. The AUC indicated self-report and behavioural measures failed to predict the occurrence of verbal or physical aggression significantly better than chance. However, the AUC was 0.71 for a positive rating as deemed by clinicians on the HCR-20v3 item C4 suggesting moderate predictive utility in detecting verbal and physical aggression.

Table 7. ROC curve analysis for measures of impulsivity detecting retrospective verbal and physical violence in secure inpatient settings

	AUC	SE	95% CI
BIS	0.57	0.09	0.39-0.75
GoStop	0.53	0.10	0.34-0.73
TwoChoice	0.34	0.09	0.17-0.51
BART	0.38	0.09	0.21-0.51
HCR-20 (C4 item)	0.71	0.08	0.55-0.87

Abbreviations: AUC, area under the curve; SE, standard error; 95% CI, 95% confidence interval.

However, it should be noted that these results be interpreted with caution in relation to the predictive utility of impulsivity measures in detecting violent and aggressive behaviours within clinical settings due to the wide confidence intervals observed.

3.5 Prospective analysis

Further statistical analysis between impulsivity and antisocial or violent behaviour was completed using prospective data. The relationship between participant's scores on measures of impulsivity and SDAS scores captured up to 6-months following administration of research tasks was examined. Mean length of follow up for antisocial and violent behaviour was 5.67 months within a range of 4 to 6 months.

3.5.1 Regression analysis for impulsivity measures as predictors of antisocial and violent behaviour

Univariate regression analyses were repeated to determine whether selected measures of impulsivity (IV) could prospectively predict participants' levels of antisocial and violent behaviour (DV) as captured through SDAS scores for the follow up period upon participants' completion of the research tasks.

Similarly, clinician ratings for HCR-20v3 item C4 ($\beta=.39$, $p=0.01$) and total BIS scores ($\beta=.306$, $p=.046$) significantly predicted antisocial and violent behaviour. Other behavioural measures of impulsivity did not reveal a meaningful interaction with future antisocial and violent behaviour as outlined in Table 8.

Table 8. Univariate regression analysis for impulsivity to predict antisocial and violent behaviour (total prospective SDAS scores)

	<i>R</i> ²	B	SE	β	95% CI
BIS	0.09	1.21*	0.59	0.31	0.23-2.39
GoStop	0.05	0.09	0.06	0.21	-0.04-0.21
TwoChoice	0.01	-0.42	0.93	-0.07	-2.29-1.45
BART	0.03	-0.02	0.02	-0.17	-0.07-0.02
HCR-20 (C4 item)	0.16	33.51*	12.21	0.39	8.85-58.18

Abbreviations: B, unstandardized regression coefficient; SE, standard error of regression coefficient; β, standardized beta coefficient 95% CI, 95% confidence interval.

*p<.05

A hierarchical multiple regression analysis was repeated to determine whether selected measures of impulsivity (IV) could prospectively predict participants' levels of antisocial and violent behaviour (DV) as captured through SDAS scores for the follow up period upon participants' completion of the research tasks. Item C4 (HCR-20v3) was inputted into the model followed by the BIS variable, informed by univariate regression analyses, to determine whether the addition of this self-report measure may supplement clinician rating of impulsivity (Table 9) in explaining variance of violent and antisocial behaviour. The addition of the BIS to the regression model accounted for an additional 6% of the variance in violent and antisocial behaviour which neared significance (p=0.07). Model 2 explained a total of 22% of the variance for violent and antisocial behaviour with a significant equation observed ($F_{(3,40)}=5.69$ p=0.01).

Table 9. Hierarchical multiple regression analysis for impulsivity to predict antisocial and violent behaviour (total prospective SDAS scores)

	Model 1			Model 2		
Variable	<i>B</i>	<i>SE</i>	β	<i>B</i>	<i>SE</i>	β
HCR-20 (item C4)	33.51	12.21	0.39	30.65	11.97	0.36
BIS				1.02	0.56	0.30
<i>R</i>²			0.16			0.22
Adj <i>R</i>²			0.14			0.18
F			7.53			5.69
Sig F Change			0.01			0.07
P value			0.01			0.01

Abbreviations: B, unstandardized regression coefficient; SE, standard error of regression coefficient; β , standardized beta coefficient 95% CI, 95% confidence interval.

3.5.2 Sensitivity and specificity of impulsivity measures to detect violent and antisocial behaviour in an inpatient setting

ROC curve analyses were also repeated (following the same procedure outlined in section 3.4.2), using prospective data to examine the sensitivity and specificity of impulsivity measures in identifying future incidents of antisocial and violent behaviour.

Consistent with the retrospective analyses, the area under the curve (AUC) indicated that isolated measures of impulsivity failed to predict the occurrence of violent incidents conducted by participants significantly better than chance (Table 10). Total BIS scores (AUC=0.61) and clinician rated HCR-20v3 C4 item (AUC=0.66) were most reliable, albeit demonstrating poor predictive validity.

Table 10. ROC curve analysis for measures of impulsivity detecting prospective incidents of violent behaviour in secure inpatient settings

	AUC	SE	95% CI
BIS	0.61	0.10	0.42-0.80
GoStop	0.35	0.15	0.06-0.64
TwoChoice	0.44	0.14	0.17-0.70
BART	0.47	0.11	0.25-0.69
HCR-20 (C4 item)	0.66	0.11	0.44-0.88

Abbreviations: AUC, area under the curve; SE, standard error; 95% CI, 95% confidence interval.

A final ROC curve analysis was performed to determine sensitivity and specificity of impulsivity measures in prospectively detecting combined incidents of verbal aggression and physical violence. As observed for the retrospective incidents, the HCR-20v3 C4 item demonstrated moderate predictive utility (AUC=0.72) in detecting combined incidents of verbal aggression and physical violence. Total BIS scores were observed to yield poor predictive validity (AUC=0.62), whilst behavioural measures failed to predict the occurrence of verbal or physical aggression significantly better than chance (Table 11).

Table 11. ROC curve analysis for measures of impulsivity detecting prospective incidents of verbal aggression and violent behaviour in secure inpatient settings

	AUC	SE	95% CI
BIS	0.62	0.09	0.44-0.79
GoStop	0.53	0.10	0.32-0.73
TwoChoice	0.37	0.09	0.19-0.55
BART	0.50	0.09	0.32-0.68
HCR-20 (C4 item)	0.72	0.08	0.55-0.88

Abbreviations: AUC, area under the curve; SE, standard error; 95% CI, 95% confidence interval.

3.5.3 Sub-sample analyses to determine whether the predictive utility of total HCR-20v3 scores are supplemented by self-report or behavioural measures of impulsivity

An additional stepwise regression analysis was performed for a sub-sample of participants ($n=37$) who had a full HCR-20v3 available. This was conducted to determine (1) whether the addition of self-report or behavioural measures of impulsivity would supplement overall HCR-20v3 ratings, and (2) the utility of full HCR-20v3 scores in predicting prospective incidents of violent and antisocial behaviour.

Total HCR-20v3 scores did not significantly predict levels of violent and antisocial behaviour ($F_{(1,35)}=0.75$, $p=0.39$). Self-report and behavioural measures were then entered into the regression model using a stepwise approach. These variables did not significantly contribute to variance of violent and antisocial behaviour for this sub-sample and were therefore excluded from the model. Additional ROC curve analyses were completed to explore the predictive utility of total HCR-20v3 scores for incidents of prospective violence ($AUC=0.55$) and violence and other forms of aggression ($AUC=0.68$) revealing poor overall predictive validity.

4. Discussion

The purpose of this study was to examine and compare the ability of self-report, behavioural and clinician rated measures of impulsive behaviour to predict levels of violent and antisocial behaviour in patients currently residing in secure forensic mental health settings. To our knowledge this is the only study to compare the clinical utility of supplementing routinely used clinician rating with potentially more objective measures of impulsivity.

Regression analyses for retrospective and prospective data revealed that assessment methods of impulsivity varied in their ability to explain variance of violent and antisocial behaviour. Clinician ratings of impulsive behaviour recorded as part of participants' violence risk assessment were shown to consistently predict violent and antisocial behaviour of inpatients in forensic mental health settings. This finding is consistent with previous research which shows the HCR-20 item C4 as being predictive of aggressive and violent behaviour in forensic populations (Coid et al, 2011; Mudde et al, 2010).

Analyses examining sensitivity and specificity of impulsivity measures in detecting incidents of verbal aggression or physical violence generally revealed poor predictive utility. However, clinician rating and self-report measures were observed to be the more accurate assessment tools in their prediction of future violent and

antisocial behaviour. It should be noted that clinician ratings for retrospective analyses in this study will have been informed by violent and antisocial behaviour observed in routine clinical practice throughout the preceding 12-months and could therefore be considered as biased. However, this may also reflect the capability of self-report and clinician rated measures to consider a wider range of impulsive behaviours in comparison to behavioural measures, designed to assess distinct components of impulsivity.

In this study, individual self-report and behavioural measures of impulsive behaviour did not consistently predict levels of violent and antisocial behaviour. Associations were observed between performance on the TwoChoice, and to a lesser extent GoStop, with violent or antisocial behaviour in the 12-month period prior to participants' involvement in the study. These associations are based on retrospective data and therefore may not adhere to methodological requirements for temporal causality. However, this finding could reflect response inhibition and delayed discounting as distinct components of impulsivity which are stable dynamic factors related to violent and antisocial acts. Conceptualising response inhibition and delayed discounting as stable dynamic factors would suggest that they may be amenable to change situationally or gradually over time (Douglas & Skeem, 2005).

The remaining measure of impulsivity, the BART, which assessed risky decision making, did not appear to explain the variance in outcome data. This may suggest that an inability to inhibit one's responses and consider consequences may be the elements of impulsive behaviour which play a larger role in the manifestation of violent and antisocial behaviours as opposed to the tendency to seek out novel, varied experiences.

Regarding self-reported impulsivity, the use of the BIS in addition to clinician rating of impulsive behaviour accounted for a modest increase of the variance for violent and antisocial behaviour. This may represent the use of measures that consider a wider range of impulsive behaviours as being more clinically useful in the context of risk assessment. However, the mean total score in this study as recorded by the BIS was below the recommended cut-off (Stanford et al, 2009) with 21% of participants scoring above this threshold. We may hypothesise this highlights an under-reporting of difficulties from participants, perhaps due to poor self-evaluation skills, low levels of insight or a fear of being negatively perceived. Development or consideration of self-report assessment tools which are

sensitive and specific to forensic or inpatient populations may help improve the accuracy of capturing self-reported impulsive behaviour in these environments.

Individuals in forensic mental health settings would perhaps be anticipated to report elevated levels of impulsivity on self-report measures in comparison to other populations due to a potentially higher prevalence of risk factors known to be associated with impulsive behaviour. Indeed, a large proportion of the sample in this study reported having sustained some form of brain injury in the past, a finding which adds to the growing literature exploring head injury in forensic populations (Williams, 2012; Williams et al, 2018). Similarly, the majority of participants were noted to have experienced significant issues with alcohol or substance misuse prior to their admission. Existing literature suggests that both brain injury and alcohol or substance misuse have been associated with elevated levels of impulsive behaviour (Schwartz, Connolly & Brauer, 2017; Schwartz, Connolly & Valgardson, 2017; Davis et al, 2017).

In a sub-sample of participants, measures of impulsivity did not appear to increase the predictive validity of total HCR-20v3 scores in detecting violent and antisocial behaviour. Furthermore, overall HCR-20v3 scores were not found to be effective in predicting levels of violent and antisocial behaviour in this sub-sample. A reduced sample size and low base rates for violent or antisocial behaviour may help to explain this finding. However, it may also reflect that a number of items contained in the HCR-20v3 fail to successfully explain levels of inpatient violent and antisocial behaviour. Further statistical analyses of the subscales included in the HCR-20v3 would be required to determine this. However, consideration of alternative risk assessment tools specific to inpatient settings may be beneficial. For example, the Dynamic Appraisal of Situational Aggression (DASA) (Ogloff & Daffern, 2006), comprising of seven items (including impulsivity, irritability and sensitivity to provocation) has shown good predictive validity for inpatient aggression in acute forensic inpatient units (Maguire, Daffern, Bowe & McKenna, 2016) and would likely place less demands on staff time and resources in compiling relevant information in comparison to other methods of risk assessment.

There is a lack of a unified understanding of impulsivity; however, it is agreed that impulsiveness is comprised of distinct aspects of a person's behaviour such as the inability to inhibit responses or consider consequences. The lack of overlap and association observed between measures in this study may further indicate separate

components of impulsivity exist. Clinically, this may reflect a necessity to use either a measure which encompasses the various aspects of impulsivity or a combination of assessment methods to assist clinicians in successfully evaluating the different elements of impulsive behaviour.

Existing literature suggests that impulsivity is influential in the manifestation of aggressive and violent behaviours. However, it should be noted that there are multiple factors which as a collective will contribute to the occurrence of violent or antisocial acts, reflected by the broad range of items considered in widely used risk assessment tools. Therefore, any risk factor examined in isolation will be limited in its predictive utility of violent and antisocial behaviours.

4.1 Strengths and limitations of the current study

This is the first study to examine and compare the predictive utility of impulsivity measures for violent and antisocial behaviour for this population in the UK, however there are limitations which should be acknowledged.

One limitation of this study was the small sample size and reduced statistical power, limiting the validity and generalisability of findings drawn from the statistical analyses. A number of factors may explain the difficulties in recruiting a larger number of participants. Firstly, recruitment to research studies in forensic psychiatric settings can be problematic. Patrick, Pruchno and Rose (1998) identified obstacles such as fear, suspicion and/or distrust of the researcher when recruiting from a psychiatric population. Kaminsky, Roberts and Brody (2003) also highlight that individuals with psychosis can possess concerns about confidentiality during the process of participating in research. Secondly, given the minimal exclusion criteria used in this study, fewer participants were deemed suitable by clinicians than expected. This may reflect caution from potential participants' RMO around patients' capacity to consent to the study.

It should be noted that the behavioural measures of impulsivity utilised in this study contain stimuli which may be considered of little relevance to the participant. This may be considered a limitation as these particular assessment tools may not provide the platform to fully assess response inhibition and impulsive decision making which replicates the emotionally provoking context encountered in individual's daily lives. The development or use of behavioural measures of impulsivity with this population which include an affective component (e.g. emotional

no-go task) may assist in assessing the individual's state impulsiveness during emotionally charged situations which may be more likely to result in violent or aggressive behaviour (Sebastian & Ahmed, 2018).

Despite attempts to be inclusive of a variety of transgressions, secure forensic settings are often well controlled environments. As a result, the opportunity for participants to display impulsive, aggressive and antisocial behaviours may be reduced due to effective risk management strategies in place. Additionally, the average follow-up period in which to capture prospective incidents was under 6-months, which may begin to explain the contrasting findings with longer term retrospective analyses. A shorter follow-up period will likely result in lower base rates of violent and antisocial behaviour which may influence findings, reflective of previous research in this field having described follow-up periods of 12-months as 'short-term' (Ullrich & Coid, 2011). The potential to generalise findings regarding the predictive validity of impulsivity measures in detecting violent or antisocial behaviour to settings other than secure forensic hospitals may be limited. Future studies may wish to consider a community-based forensic sample with less restricting environmental factors present, which potentially allow participants the opportunity to act more impulsively.

A strength of this research is that to the author's knowledge this is the first study to compare a number of different methods to assess impulsivity, which may help clinicians to consider how they evaluate impulsive behaviour in their routine practice. A further strength is the use of prospective data to consider whether impulsivity contributes to incidence of violent and antisocial behaviour in a forensic mental health population. However, future studies may wish to consider a longitudinal design utilising longer follow-up periods to provide further knowledge of the temporal relationship between distinct components of impulsivity (e.g. response inhibition or delayed gratification) and violent or antisocial behaviour. This would potentially allow more of an opportunity to capture incidents of violent and antisocial behaviour, which would prove valuable given the well-controlled environments of secure settings. Finally, one positive in relation to the recruitment of this study is that the sample was drawn from four secure hospitals, and therefore representative of forensic mental health inpatients across each level of security.

4.2 Conclusions

Violent and antisocial behaviours are multifactorial in nature as represented by the wide range of factors commonly considered in risk assessment tools, therefore the relative contribution of any one risk factor is likely to be limited. However, in support of previous literature in this field we found a relatively consistent relationship (dependent on assessment method) between impulsive behaviour and violent or antisocial behaviour in a sample of inpatients in forensic mental health settings.

Upon comparison of assessment tools measuring impulsive behaviour, those which were found to be most predictive of future violence and antisocial behaviour were self-report (BIS) and clinician ratings (HCR-20 v3 item C4). These measures encompass a wider scope of impulsive behaviours in contrast to behavioural measures, specifically designed to tap into distinct components of impulsivity (e.g. response inhibition or delayed gratification). This finding may encourage clinicians or professionals working within inpatient forensic mental health and criminal justice settings to consider the use of the BIS to supplement clinician rating when assessing impulsive behaviour, specifically for risk assessment purposes.

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LIST OF APPENDICES

Appendix A: Journal of Aggression and Violent Behaviour author guidelines

Appendix B: Quality assessment tool

Appendix C: Quality assessment scores for each included paper

Appendix D: Journal of Criminal Justice author guidelines

Appendix E: Ethical approval documentation

Appendix F: Participant information sheet

Appendix G: Participant consent form

Appendix A: Journal of Aggression and Violent Behaviour author guidelines



AGGRESSION AND VIOLENT BEHAVIOR

TABLE OF CONTENTS

- **Description p.1**
- **Impact Factor p.1**
- **Abstracting and Indexing p.2**
- **Editorial Board p.2**
- **Guide for Authors p.4**

DESCRIPTION

AUTHOR INFORMATION PACK

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Aggression and Violent Behavior, A Review Journal is a multidisciplinary journal that publishes substantive and integrative reviews, as well as summary reports of innovative ongoing clinical research programs on a wide range of topics germane to the field of **aggression** and **violent behavior**. Papers encompass a large variety of issues, populations, and domains, including homicide (serial, spree, and mass murder; sexual homicide), sexual deviance and assault (rape, serial rape, child molestation, paraphilias), child and youth violence (firesetting, gang violence, juvenile sexual offending), family violence (child physical and sexual abuse, child neglect, incest, spouse and elder abuse), genetic predispositions, and the physiological basis of aggression.

Manuscripts that articulate disparate orientations will be welcomed, given that this journal will be cross-disciplinary and cross-theoretical. Indeed, papers will

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Appendix B: Quality assessment tool

Operationalised NICE Checklist for Quantitative Studies Reporting on Correlations and Associations	
Author:	
Date:	
Title:	
Scoring criteria:	
Definitely – 2	
Partially - 1	
No – 0	
Not reported – NR	
Item	Score
1. Does the study address an appropriate and clearly focused question (e.g. is there a clinical or theoretical rationale for the research)?	
2. Are the aims of the study specific and appropriate (e.g. clearly outlined 'aims' or 'hypotheses' section that are consistent with rationale in item 1)?	
Population	
3. Is the source area and population clearly described to sufficient detail to allow for comparison and generalisability?	
4. Is the recruitment of eligible population well defined?	
5. Was the method of participant selection from the eligible population well described (e.g. inclusion/exclusion criteria explicit)?	
6. Are descriptive statistics of participants key characteristics provided?	
7. Do the sampled participants appear sufficiently representative of the population?	
Outcome	
8. Were the outcome measures objective?	
9. Did the outcome measures have adequate reliability?	
10. Were the outcome measures well validated?	
Analyses	
11. Was the study sufficiently powered to detect an intervention effect (e.g. with a power of 0.8, it is likely to see an effect of a given size if one exists, 80% of the time)?	
12. Are the statistical methods appropriate for the study design (for example, impulsivity as dependent variable in statistical analysis)?	
13. Were confidence intervals or p values for effect estimates given or possible to calculate?	
Internal & external validity	Tick one as appropriate
++ All or most of the checklist criteria have been fulfilled, where they have not been fulfilled the conclusions are very unlikely to alter	
+ Some of the checklist criteria have been fulfilled, where they have not been fulfilled, or not adequately described, the conclusions are unlikely to alter	
- Few or no checklist criteria have been fulfilled and the conclusions are likely or very likely to alter	

Appendix C: Quality assessment scores for each included paper

	Bevilacqua et al (2012)	Carli et al (2014)	Davis et al (2017)	Kamphuis et al (2014)	Schwartz, Connolly & Brauer	Schwartz, Connolly &	Sergentanis et al (2014)	Van Veen, Karsten & Lancel (2017)	Walters & Kiehl (2015)
1. Clear study rationale	2	2	2	2	2	2	2	2	2
2. Specific study aims	2	2	2	2	2	2	2	2	2
3. Clearly described source area	2	2	2	2	2	2	1	2	1
4. Recruitment process well defined	2	2	1	1	1	1	2	2	1
5. Explicit inclusion/exclusion criteria	1	2	1	0	1	1	2	1	2
6. Descriptive statistics	1	1	1	2	1	1	2	2	1
7. Well represented sample	1	1	2	1	2	2	2	1	0
8. Objective outcome measure(s)	1	1	1	1	1	1	1	1	2
9. Reliable outcome measure(s)	1	1	1	1	1	1	1	1	1
10. Validated outcome measure(s)	1	1	1	1	1	1	1	1	NR
11. Power calculation	NR	NR	NR	NR	NR	NR	NR	NR	NR
12. Appropriate statistical analyses	2	2	2	2	2	2	2	2	2
13. Stats available for effect estimates	1	2	2	1	2	2	2	2	2
Total quality (max 26)	17	19	18	16	18	18	20	19	16
Total quality (%)	65	73	69	62	69	69	77	73	62

Appendix D: Journal of Criminal Justice author guidelines



JOURNAL OF CRIMINAL JUSTICE

An International Journal

TABLE OF CONTENTS

- **Description p.1**
- **Audience p.1**
- **Impact Factor p.1**
- **Abstracting and Indexing p.2**
- **Editorial Board p.2**
- **Guide for Authors p.5**

DESCRIPTION

AUTHOR INFORMATION PACK

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The Journal of Criminal Justice is an international journal intended to fill the present need for the dissemination of new information, ideas and methods, to both practitioners and academicians in the **criminal justice** area. The *Journal* is concerned with all aspects of the **criminal justice system** in terms of their relationships to each other. Although materials are presented relating to crime and the individual elements of the criminal justice system, the emphasis of the *Journal* is to tie together the functioning of these elements and to illustrate the effects of their interactions. Articles that reflect the application of new disciplines or analytical methodologies to the problems of criminal justice are of special interest.

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concise and informative. The title of your article must be clear and descriptive, using words that are relevant to the subject area, and would most likely be used in an online search. Avoid abbreviations and formulae where possible.

- **Author names and affiliations.** Where the family name may be ambiguous (e.g., a double name), please indicate this clearly. Present the authors' affiliation addresses (where the actual work was done) below the names. Indicate all affiliations with a lower-case superscript letter immediately after the author's name and in front of the appropriate address. Provide the full postal address of each affiliation, including the country name, and, if available, the e-mail address of each author.

- **Corresponding author.** Clearly indicate who will handle correspondence at all stages of refereeing and publication, also post-publication. **Ensure that telephone and fax numbers (with country and area code) are provided in addition to the e-mail address and the complete postal address.**

- **Present/permanent address.** If an author has moved since the work described in the article was done, or was visiting at the time, a "Present address" (or "Permanent address") may be indicated as a footnote to that author's name. The address at which the author actually did the work must be retained as the main, affiliation address. Superscript Arabic numerals are used for such footnotes.

Abstract

Authors should provide a structured abstract which should be no more than 200 words in length. The structured abstract (see example below) should succinctly state the purpose of the study, basic procedures, most important findings, and principal conclusions, with an emphasis on the new aspects of the study. An abstract is often presented separately from the article, so it must be able to stand alone. For this reason, references should be avoided, but if essential, then cite the author(s) and year(s). Also, non-standard uncommon abbreviations should be avoided, but if essential they must be defined at their first mention in the abstract itself.

An example of the structured abstract is: Purpose:

Methods:

Results:

Conclusions:

Highlights

Highlights are mandatory for this journal. They consist of a short collection of bullet points that convey the core findings of the article and should be submitted in a separate editable file in the online submission system. Please use 'Highlights' in the file name and include 3 to 5 bullet points (maximum 85 characters, including spaces, per bullet point). You can view example Highlights on our information site.

Keywords

Immediately after the abstract, provide a maximum of 6 keywords, using American spelling and avoiding general and plural terms and multiple concepts

(avoid, for example, 'and', 'of'). Be sparing with abbreviations: only abbreviations firmly established in the field may be eligible. These keywords will be used for indexing purposes.

Acknowledgements

Collate acknowledgements in a separate section at the end of the article before the references and do not, therefore, include them on the title page, as a footnote to the title or otherwise. List here those individuals who provided help during the research (e.g., providing language help, writing assistance or proof reading the article, etc.).

Formatting of funding sources

List funding sources in this standard way to facilitate compliance to funder's requirements:

Funding: This work was supported by the National Institutes of Health [grant numbers xxxx, yyyy]; the Bill & Melinda Gates Foundation, Seattle, WA [grant number zzzz]; and the United States Institutes of Peace [grant number aaaa].

It is not necessary to include detailed descriptions on the program or type of grants and awards. When funding is from a block grant or other resources available to a university, college, or other research institution, submit the name of the institute or organization that provided the funding.

If no funding has been provided for the research, please include the following sentence:

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

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Electronic artwork

General points

- Make sure you use uniform lettering and sizing of your original artwork.
- Embed the used fonts if the application provides that option.
- Aim to use the following fonts in your illustrations: Arial, Courier, Times New Roman, Symbol, or use fonts that look similar.
- Number the illustrations according to their sequence in the text.
- Use a logical naming convention for your artwork files.
- Provide captions to illustrations separately.
- Size the illustrations close to the desired dimensions of the published version.
- Submit each illustration as a separate file.

A detailed guide on electronic artwork is available.

You are urged to visit this site; some excerpts from the detailed information are given here. *Formats*

If your electronic artwork is created in a Microsoft Office application (Word, PowerPoint, Excel) then please supply 'as is' in the native document format. Regardless of the application used other than Microsoft Office, when your electronic artwork is finalized, please 'Save as' or convert the images to one of the following formats (note the resolution requirements for line drawings, halftones, and line/halftone combinations given below):

EPS (or PDF): Vector drawings, embed all used fonts.

TIFF (or JPEG): Color or grayscale photographs (halftones), keep to a minimum of 300 dpi.

TIFF (or JPEG): Bitmapped (pure black & white pixels) line drawings, keep to a minimum of 1000 dpi. TIFF (or JPEG): Combinations bitmapped line/half-tone (color or grayscale), keep to a minimum of 500 dpi.

Please do not:

- Supply files that are optimized for screen use (e.g., GIF, BMP, PICT, WPG); these typically have a low number of pixels and limited set of colors;
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- Submit graphics that are disproportionately large for the content.

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Ensure that each illustration has a caption. Supply captions separately, not attached to the figure. A caption should comprise a brief title (**not** on the figure itself) and a description of the illustration. Keep text in the illustrations themselves to a minimum but explain all symbols and abbreviations used.

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Please submit tables as editable text and not as images. Tables can be placed either next to the relevant text in the article, or on separate page(s) at the end. Number tables consecutively in accordance with their appearance in the text and place any table notes below the table body. Be sparing in the use of tables and ensure that the data presented in them do not duplicate results described elsewhere in the article. Please avoid using vertical rules and shading in table cells.

Citation in text

Please ensure that every reference cited in the text is also present in the reference list (and vice versa). Any references cited in the abstract must be given in full. Unpublished results and personal communications are not recommended in the reference list, but may be mentioned in the text. If these references are included in the reference list they should follow the standard reference style of the journal and should include a substitution of the publication date with either 'Unpublished results' or 'Personal communication'. Citation of a reference as 'in press' implies that the item has been accepted for publication and a copy of the title page of the relevant article must be submitted.

Web references

As a minimum, the full URL should be given and the date when the reference was last accessed. Any further information, if known (DOI, author names, dates, reference to a source publication, etc.), should also be given. Web references can be listed separately (e.g., after the reference list) under a different heading if desired, or can be included in the reference list.

Data references

This journal encourages you to cite underlying or relevant datasets in your manuscript by citing them in your text and including a data reference in your Reference List. Data references should include the following elements: author name(s), dataset title, data repository, version (where available), year, and global persistent identifier. Add [dataset] immediately before the reference so

we can properly identify it as a data reference. The [dataset] identifier will not appear in your published article.

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Reference style

Text: Citations in the text should follow the referencing style used by the American Psychological Association. You are referred to the Publication Manual of the American Psychological Association, Sixth Edition, ISBN 978-1-4338-0561-5, copies of which may be ordered online or APA Order Dept., P.O.B. 2710, Hyattsville, MD 20784, USA or APA, 3 Henrietta Street, London, WC3E 8LU, UK.

List: references should be arranged first alphabetically and then further sorted chronologically if necessary. More than one reference from the same author(s) in the same year must be identified by the letters 'a', 'b', 'c', etc., placed after the year of publication.

Examples:

Reference to a journal publication:

Van der Geer, J., Hanraads, J. A. J., & Lupton, R. A. (2010). The art of writing a scientific article. *Journal of Scientific Communications*, 163, 51–59.

Reference to a book:

Strunk, W., Jr., & White, E. B. (2000). *The elements of style*. (4th ed.). New York: Longman, (Chapter 4).

Reference to a chapter in an edited book:

Mettam, G. R., & Adams, L. B. (2009). How to prepare an electronic version of your article. In B. S. Jones, & R. Z. Smith (Eds.), *Introduction to the electronic age* (pp. 281–304). New York: E-Publishing Inc.

Reference to a website:

Cancer Research UK. Cancer statistics reports for the UK. (2003).

<http://www.cancerresearchuk.org/aboutcancer/statistics/cancerstatsreport/>
Accessed 13.03.03.

Reference to a dataset:

[dataset] Oguro, M., Imahiro, S., Saito, S., Nakashizuka, T. (2015). *Mortality data for Japanese oak wilt disease and surrounding forest compositions*.

Mendeley Data, v1. <https://doi.org/10.17632/xwj98nb39r.1>.

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Supplementary material such as applications, images and sound clips, can be published with your article to enhance it. Submitted supplementary items are published exactly as they are received (Excel or PowerPoint files will appear as

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Appendix E: Ethical approval documentation

WoSRES
West of Scotland Research Ethics Service



Mr Max Alford
Trainee Clinical Psychologist
University of Edinburgh/NHS Fife
Lynebank Hospital
Halbeath Road
Dunfermline
KY11 4UW

West of Scotland REC 4
Research Ethics
Clinical Research and Development
West Glasgow Ambulatory Care Hospital
Dalnair Street
Glasgow
G3 8SJ
(Formerly Yorkhill Childrens Hospital)

Date 27 April 2017
Direct line 0141 232 1808
E-mail WoSREC4@ggc.scot.nhs.uk

Dear Mr Alford

Study title: An investigation into behavioural impulsivity in forensic mental health units - a comparison of the predictive validity of instruments to identify risk of violence and antisocial behaviour
REC reference: 17/WS/0070
IRAS project ID: 217735

Thank you for your full submission of 27 April 2017. I can confirm the REC has received the documents listed below and that these comply with the approval conditions detailed in our letter dated 11 April 2017.

Documents received

The documents received were as follows:

Document	Version	Date
GP/consultant information sheets or letters [Clinician Information Sheet]	v3	25 April 2017
Participant consent form [Participant consent form]	v4	27 April 2017
Participant information sheet (PIS) [Participant Information Sheet]	V3	25 April 2017

Approved documents

The final list of approved documentation for the study is therefore as follows:

Document	Version	Date
Evidence of Sponsor insurance or indemnity (non NHS Sponsors only) [Certificate of Employers' Liability Insurance]		01 August 2016
GP/consultant information sheets or letters [Clinician Information Sheet]	v3	25 April 2017
Other [Additional University of Edinburgh Insurance Document]		21 July 2016
Other [Professional Indemnity Insurance]		25 July 2016
Participant consent form [Participant consent form]	v4	27 April 2017
Participant information sheet (PIS) [Participant Information Sheet]	V3	25 April 2017
REC Application Form [REC_Form_15032017]		15 March 2017
Research protocol or project proposal [Research Protocol]	v1	15 March 2017
Summary CV for Chief Investigator (CI) [Chief Investigator CV]		
Summary CV for supervisor (student research) [Academic Supervisor CV]		

You should ensure that the sponsor has a copy of the final documentation for the study. It is the sponsor's responsibility to ensure that the documentation is made available to R&D offices at all participating sites.

17/WS/0070

Please quote this number on all correspondence

Yours sincerely



Rozanne Suarez
REC Manager

Copy to: *Charlotte Smith*
Mr Jamie Pitcairn, The State Hospitals Board for Scotland

Mr Max Alford
Trainee Clinical Psychologist
University of Edinburgh/NHS Fife
Lynebank Hospital
Halbeath Road
Dunfermline
KY11 4UW

West of Scotland REC 4
Research Ethics
Clinical Research and Development
West Glasgow Ambulatory Care Hospital
Dalnair Street
Glasgow
G3 8SJ
(Formerly Yorkhill Childrens Hospital)

Date 31 August 2017
Direct line 0141 232 1808
E-mail WoSREC4@ggc.scot.nhs.uk

Dear Mr Alford

Study title: An investigation into behavioural impulsivity in forensic mental health units - a comparison of the predictive validity of instruments to identify risk of violence and antisocial behaviour
REC reference: 17/WS/0070
Amendment number: 1 - 10/08/2017 (REC Ref AM01)
Amendment date: 18 August 2017
IRAS project ID: 217735

Summary of Amendment

This amendment relates to:-

1) In addition to the current permission to prospectively collect the specified information from patient case notes and DATIX incident forms for the 6 months subsequent to assessment, to extend this same data collection retrospectively to the 12 months prior to assessment.

2) To allow participants who are transferred during the 6 month follow up period to remain in the study through permission to follow their progress, using the same methods, at their subsequent placement.

The above amendment was reviewed by the Sub-Committee in correspondence.

Ethical opinion

The members of the Sub-Committee taking part in the review gave a favourable ethical opinion of the amendment on the basis described in the notice of amendment form and supporting documentation.

Approved documents

The documents reviewed and approved at the meeting were:

Document	Version	Date
Notice of Substantial Amendment (non-CTIMP)	1 - 10/08/2017 (REC Ref AM01)	18 August 2017
Participant consent form	5	15 August 2017
Participant information sheet (PIS)	4	15 August 2017
Research protocol or project proposal	2	10 August 2017

Membership of the Sub-Committee

The members of the Sub-Committee who took part in the review are listed on the attached sheet.

Working with NHS Care Organisations

Sponsors should ensure that they notify the R&D office for the relevant NHS care organisation of this amendment in line with the terms detailed in the categorisation email issued by the lead nation for the study.

Statement of compliance

The Committee is constituted in accordance with the Governance Arrangements for Research Ethics Committees and complies fully with the Standard Operating Procedures for Research Ethics Committees in the UK.

We are pleased to welcome researchers and R & D staff at our Research Ethics Committee members' training days – see details at <http://www.hra.nhs.uk/hra-training/>

17/WS/0070:	Please quote this number on all correspondence
--------------------	---

Yours sincerely



On behalf of
Dr Ken James
Chair

Enclosures: *List of names and professions of members who took part in the review*

Copy to: *Mr Jamie Pitcairn, The State Hospitals Board for Scotland
Charlotte Smith*

13 October 2017

Mr Max Alford
Trainee Clinical Psychologist
University of Edinburgh/NHS Fife
Lynebank Hospital
Halbeath Road
Dunfermline
KY11 4UW

Dear Mr Alford,

R&D MANAGEMENT APPROVAL – TAYSIDE

Title: An investigation into behavioural impulsivity in forensic mental health units - a comparison of the predictive validity of instruments to identify risk of violence and antisocial behaviour

Chief Investigator: Mr Max Alford

Principal Investigator/Local Collaborator: Mr Max Alford

Tayside Ref: 2017MH07 NRS Ref: NRS17/217735

REC Ref: 17/WS/0070

Sponsor: University of Edinburgh

Funder: No External Funding

Many thanks for your application to carry out the above project here in NHS Tayside. I am pleased to confirm that the project documentation (as outlined below) has been reviewed, registered and Management Approval has been granted for the study to proceed locally in Tayside.

Approval is granted on the following conditions:-

- ALL Research must be carried out in compliance with the Research Governance Framework for Health & Community Care, Health & Safety Regulations, data protection principles, statutory legislation and in accordance with Good Clinical Practice (GCP).
- All amendments to be notified to TASC R&D Office via the correct amendment pathway. Either direct to the R&D Office or via the Lead Co-ordinating Centre depending on how the study is set up (<http://www.hra.nhs.uk/nhshsc-rd-uk-process-management-amendments/>).
- All local researchers must hold either a Substantive Contract, Honorary Research Contract, Honorary Clinical Contract or Letter of Access with NHS Tayside where required (<http://www.nihr.ac.uk/about-us/CCF/policy-and-standards/research-passports.htm>).

- TASC R&D Office to be informed of change in Principal Investigator, Chief Investigator or any additional research personnel locally.
- Notification to TASC R&D Office of any change in funding.
- As custodian of the information collated during this research project you are responsible for ensuring the security of all personal information collected in line with NHS Scotland IT Security Policies, until destruction of this data.
- All eligible and adopted studies will be added to the Central Portfolio Management System (CPMS). Recruitment figures for eligible and adopted studies must be recorded onto the Portfolio every month. This is the responsibility of the lead UK site. If you are the lead, or only UK site, we can provide help or advice with this. For information, contact Sarah Kennedy (01382 383882 or sarah.kennedy17@nhs.net) or Laura Stephen (01382 383985 or laura.stephen2@nhs.net).
- Annual reports are required to be submitted to TASC R&D Office with the first report due 12 months from date of issue of this management approval letter and at yearly intervals until completion of the study.
- Notification of early termination within 15 days or End of Trial within 90 days followed by End of Trial Report within 1 year to TASC R&D Office.
- You may be required to assist with and provide information in regard to audit and monitoring of study.

Please note you are required to adhere to the conditions, if not, NHS management approval may be withdrawn for the study.

Approved Documents

Document	Version	Date
IRAS R&D form		
IRAS SSI form		
REC Favourable Opinion Letter		27/04/2017
Notice of Substantial Amendment (non-CTIMP)	AM01	10/08/2017
REC AM01 Favourable Opinion Letter		31/08/2017
Consent form	5.0	15/08/2017
Patient Information sheet	4.0	15/08/2017
Protocol	2.0	10/08/2017
GP/consultant information sheets or letters [Clinical Information Sheet]	3.0	25/04/2017
Insurance (Professional Indemnity)		04/08/2017
Insurance (Clinical Trial Liability)		27/07/2017
Insurance (Public, Products & Employers Liability)		26/07/2017
Mr Max Alford CV		
Dr Suzanne O'Rourke CV		

May I take this opportunity to wish you every success with your project.

Please do not hesitate to contact TASC R&D Office should you require further assistance.

Yours sincerely



Elizabeth Coote
Head of Non-Commercial Research Services

TAyside medical Science Centre (TASC)
Ninewells Hospital & Medical School
TASC Research & Development Office
Residency Block, Level 3
George Pirie Way
Dundee DD1 9SY
Email: liz.coote@nhs.net
Tel: 01382 383876 Fax: 01382 740122

C.c. Dr Suzanne O'Rourke – Suzanne.o'rourke@ed.ac.uk
Miss Charlotte Smith – Charlotte.smith@ed.ac.uk

Administrator: Mrs Elaine O'Neill
Telephone Number: 0141 232 1815
E-Mail: elaine.o'neill2@ggc.scot.nhs.uk
Website: www.nhsggc.org.uk/r&d

R&D Management Office
West Glasgow ACH
Dalnair Street
Glasgow G3 8SW

16 October 2017

Mr Max Alford
Trainee Clinical Psychologist
University of Edinburgh
Lynebank Hospital
Halbeath Road
Dunfermline KY11 4UW

NHS GG&C Board Approval

Dear Mr M Alford,

Study Title:	An investigation into behavioural impulsivity in forensic mental health units - a comparison of the predictive validity of instruments to identify risk of violence and antisocial behaviour
Principal Investigator:	Mr Max Alford
GG&C HB site	Community Mental Health
Sponsor	University of Edinburgh
R&D reference:	GN17MH588
REC reference:	17/WS/0070
Protocol no:	V2; 10/08/2017

I am pleased to confirm that Greater Glasgow & Clyde Health Board is now able to grant **Approval** for the above study.

Conditions of Approval

1. **For Clinical Trials** as defined by the Medicines for Human Use Clinical Trial Regulations, 2004
 - a. During the life span of the study GGHB requires the following information relating to this site
 - i. Notification of any potential serious breaches.
 - ii. Notification of any regulatory inspections.

It is your responsibility to ensure that all staff involved in the study at this site have the appropriate GCP training according to the GGHB GCP policy (www.nhsggc.org.uk/content/default.asp?page=s1411), evidence of such training to be filed in the site file.

2. **For all studies** the following information is required during their lifespan.
 - a. Recruitment Numbers on a monthly basis
 - b. Any change of staff named on the original SSI form
 - c. Any amendments – Substantial or Non Substantial
 - d. Notification of Trial/study end including final recruitment figures
 - e. Final Report & Copies of Publications/Abstracts

Please add this approval to your study file as this letter may be subject to audit and monitoring.

Your personal information will be held on a secure national web-based NHS database.

I wish you every success with this research study

Yours sincerely,



Mrs Elaine O'Neill
Senior Research Administrator

Cc: Charlotte Smith (University of Edinburgh)
Dr Emma Drysdale (NHS GG&C)

Medical Director

Hayfield House
Hayfield Road
KIRKCALDY
KY2 5AH



Mr Max Alford
Trainee Clinical Psychologist
Lynebank Hospital
Halbeath Road
DUNFERMLINE
KY11 4UW

Date 13 October 2017
Our Ref
Enquiries to Aileen Yell
E-mail aileen.yell@nhs.net
Telephone 01383 623623 Ext 20940
Website www.nhsfife.org

Dear Mr Alford

Project Title: Assessing behavioural impulsivity in forensic mental health

Thank you for your application to carry out the above project. Your project documentation (detailed below) has been reviewed for resource and financial implications for NHS Fife and I am happy to inform you that NHS permission for the above research has been granted on the basis described in the application form, protocol and supporting documentation. The documents reviewed were:

Document	Version	Date
REC final favourable opinion letter		27 April 2017
Protocol	2	10 August 2017
Participant Information Sheet	4	15 August 2017
Participant Consent Form	5	15 August 2017
REC favourable opinion letter for amendment AM01		31 August 2017
IRAS R&D Form	5.5.2	10 October 2017
Study-Wide Governance Report		11 October 2017
IRAS SSI Form	5.5.2	11 October 2017

The terms of the approval state that you are the Principal Investigator authorised to undertake this study within NHS Fife, with assistance from Dr Lynda Todd, Consultant Clinical Psychologist in Fife. I note that the favourable ethical opinion applies to all NHS sites taking part in the study therefore no separate Site Specific Review is required in this case.

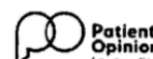
Where applicable, independent contractors (e.g. General Practitioners) should ensure that the professional indemnity provided by their medical defence organisation covers the activities expected of them for this research study

The sponsors for this study are University of Edinburgh.

Details of our participation in studies will be included in annual returns we are expected to complete as part of our agreement with the Chief Scientist Office. Regular reports of the study require to be submitted. Your first report should be submitted to Dr A Wood, R&D Manager, R&D Department, Queen Margaret Hospital, Whitefield Rd, Dunfermline, KY12 0SU (Amanda.wood3@nhs.net) in 12 months time and subsequently at yearly intervals until the work is completed. A Lay Summary will also be required upon completion of the project.

In addition, approval is granted subject to the following conditions:-

¹ NHS Fife was awarded the Carbon Trust Standard in February 2010 and is the first Scottish NHS Board to achieve this accolade.



All research activity must comply with the standards detailed in the Research Governance Framework for Health & Community Care (<http://www.cso.scot.nhs.uk/publications/resgov/resgov.htm>), health & safety regulations, data protection principles, other appropriate statutory legislation and in accordance with Good Clinical Practice (GCP).

Any amendments which may subsequently be made to the study should also be notified to Aileen Yell, R&D Research Coordinator (aileen.yell@nhs.net), as well as the appropriate regulatory authorities. Notification should also be given of any new research team members post approval and/or any changes to the status of the project.

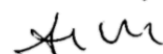
This organisation is required to monitor research to ensure compliance with the Research Governance Framework and other legal and regulatory requirements. This is achieved by random audit of research. You will be required to assist with and provide information in regard to monitoring and study outcomes (including providing recruitment figures to the R&D office as and when required).

As custodian of the information collated during this research project you are responsible for ensuring the security of all personal information collected in line with NHS Scotland IT Security Policies, until the destruction of this data. Permission is only granted for the activities for which a favourable opinion has been given by the REC (and which have been authorised by the MHRA where appropriate).

The research sponsor or the Chief Investigator or local Principal Investigator at a research site may take appropriate urgent safety measures in order to protect research participants against any immediate hazard to their health or safety. The R&D office (aileen.yell@nhs.net) should be notified that such measures have been taken. The notification should also include the reasons why the measures were taken and the plan for further action. The R&D office should be notified within the same time frame of notifying the REC and any other regulatory bodies.

I would like to wish you every success with your study and look forward to receiving a summary of the findings for dissemination once the project is complete.

Yours sincerely



DR FRANCES ELLIOT
Medical Director
NHS Fife

*Cc : Aileen Yell, R&D Research Coordinator, NHS Fife, Queen Margaret Hospital, Dunfermline
Dr Lynda Todd, NHS Fife (by e-mail)*

Max Alford
Trainee Clinical Psychologist
NHS Fife

Monday the 13th of March 2017

Dear Max,

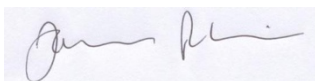
Re: An investigation into behavioural impulsivity in forensic mental health units - a comparison of the predictive validity of instruments to identify violence risk

Many thanks for your revised research proposal and covering letter in response to the TSH Research Committee feedback. The committee found the proposal to be an interesting piece of work, and are now satisfied that you have addressed all of the points raised within the review feedback. This letter will be copied to the Associate Medical Director along with evidence of your ethical approval, and will subsequently provide final management approval for the study to take place within TSH.

One condition of the research committees' approval is that you provide the committee with regular 6-monthly progress reports. This is an important mechanism by which the committee track progress, and is also a key component of our research governance processes. The committee would also request a study final report focusing on the implementation of study findings into clinical practice.

If you require any further assistance, or have any feedback on the Research approval process then please do not hesitate to contact me.

Yours sincerely



JAMIE PITCAIRN
Research & Development Manager
The State Hospital

The State Hospital

Carstairs
Lanark ML11 8RP
Telephone 01555 840293
Fax 01555 840024
E-mail info@tsh.nhs.uk
<http://www.tsh.scot.nhs.uk>



Max Alford
Trainee Clinical Psychologist
Lynebank Hospital
Halbeath Road
Dunfermline
KY11 4UW

Date 20 April 2017
Your Ref
Our Ref DA/ag

Enquiries to Ann Gallacher
Direct Line 01555 842221
E-mail ann.gallacher1@nhs.net

Dear Mr Alford

Re: An investigation into behavioural instability in forensic mental health units – a comparison of the predictive validity of instruments to identify violence risk

Having considered the views of the Research Committee and noted that you have obtained Ethical Approval from the West of Scotland Research Ethics Service, I write to give you Managerial Approval to proceed with your project. This is subject to you fulfilling the requirements of the Ethics Committee and of the State Hospital Research Committee.

May I take this opportunity to wish you every success in your endeavour.

Yours sincerely

Dr Duncan Alcock
Associate Medical Director

cc. Jamie Pitcairn, Research and Development Manager.
Professor Lindsay Thomson, Medical Director.



The State Hospitals Board for Scotland
Carstairs, Lanark, ML11 8RP.

Chair Terry Currie
Chief Executive James Crichton

APPENDIX F: Participant information sheet



THE UNIVERSITY
of EDINBURGH



*(*This NHS logo will be
changed for each
recruitment site*)*

**University of Edinburgh
School of Health in Social Science
Medical School (Doorway 6)
Teviot Place
EH8 9AG**

Participant Information Sheet

Assessing impulsive behaviour of patients within secure unit settings

An investigation into behavioural impulsivity in forensic mental health units - a comparison of the predictive validity of instruments to identify violence risk

V4: 15/08/2017

You are being invited to participate in a research study. Before you decide whether you would like to take part we would like you to understand the purpose of this study and what your participation would involve. A member of our research team will go through this information sheet with you and answer any questions you may have.

Ask us if there

is anything that is not clear or if you would like more information. Take time to decide whether or not you wish to take part.

What is the purpose of the study?

Our research wants to find out if being impulsive can lead to being more anti-social or aggressive. Being impulsive is when someone tends to act without stopping to think or without considering the consequences.

Why have I been invited?

Our study will be recruiting individuals who reside in NHS forensic mental health settings. As you are currently an inpatient within (enter appropriate NHS centre) we would like to offer you the opportunity to take part in our study.

Do I have to take part?

No, you do not have to take part. Your participation is voluntary and deciding not to take part will not impact on the level of care you currently receive.

What will I have to do?

If you decide to volunteer, you will be asked to complete three short tasks on a computer and a questionnaire. These will be to assess how impulsive you are. A member of the research team will visit you on your ward and it will take about 30-40mins to complete the tasks.

If you decide to volunteer, we will ask your permission to access some relevant parts of your medical records for the period 12 months before, and up to 6 months after completing the computer-based tasks and questionnaire. These will only be looked at by members of the research team.

What are the possible risks?

Completing the tasks is not a painful or dangerous process in any way as two are a little like computer games and one is a questionnaire. You may find concentrating for this long tiring, but you will be able to take a break or stop and withdraw from the study at any time. It should be noted that we intend to retain and use the responses you have provided in the event you are to lose capacity after having provided consent.

What are the possible benefits?

The tests are not a form of treatment and may not directly benefit you. However, we hope that eventually this research will help us to measure how impulsive people are more accurately and help us know whether this is related to their behavior.

Will my participation be confidential?

If you choose to take part only members of the research team will know. We will also inform your GP and/or Psychiatrist of your involvement in the study. We hope that the results of this study will be published in a scientific journal or presented at a conference, but no names will be included and it will not be possible for you to be identified.

In addition, relevant sections of your medical notes and data collected during the study may be looked at by individuals from the regulatory authorities and from the Sponsor(s) (NHS Lothian and the University of Edinburgh) or from the/other NHS Board(s) relevant to your taking part in this research.

What if I want to stop the study?

Whether you take part is up to you and your decision, and you will continue to receive the same care whether you take part or not.

You may change your mind about being in the study and withdraw your consent after the study has started. Your continued treatment will not be affected by your decision to take part or not in this study, even if you change your mind half way through.

What if I have further questions?

Thank you for taking the time to hear about our study. We would be really pleased to talk to you about it some more if you have any questions. If you have any further questions about the study, please contact or ask your keyworker to contact Max Alford on 01383 565 402.

What if there is a problem?

If you wish to make a complaint about the study please contact NHS (enter appropriate health board):

Complaints Officer

(Enter address)

(Enter telephone number)

(Enter email address)

APPENDIX G: Participant consent form



THE UNIVERSITY
of EDINBURGH



University of Edinburgh
School of Health in Social Science
Medical School (Doorway 6)
Teviot Place
EH8 9AG

Participant Consent Form

CONSENT TO PARTICIPATE IN A RESEARCH STUDY V5 15/08/2017:

Participant identification ID

Study: Assessing impulsive behaviour of patients within secure unit settings

Investigator: Mr Max Alford (Trainee Clinical Psychologist, University of Edinburgh)

Please initial box

1. I confirm that I have read and understand the information sheet (version 4 - 15/08/2017) for the above study and have had the opportunity to consider the information and ask questions.
2. I understand that my participation is voluntary and that I am free to withdraw at any time, without giving any reason, without my medical care or legal rights being affected.
3. I understand that relevant sections of my medical notes and data collected during the study may be looked at by individuals from the regulatory authorities and from the Sponsor(s) (NHS Lothian and the University of Edinburgh) or from the/other NHS Board(s) where it is relevant to my taking part in this research. I give my permission for those individuals to have access to my records.
4. I agree to my anonymised data being used in future ethically approved studies.
5. I agree to my Psychiatrist being informed of my participation in this study
6. I agree to take part in the above study.

Name of Participant

Date

Signature

Name of Person taking consent

Date

Signature